OLDEST AND MOST WIDELY READ AND QUOTED ELECTRICAL WEEKLY IN THE UNITED STATES.

ELECTRICAL REVIEW

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VIEWS, NEWS AND INTERVIEWS.

In a recent communication to the Paris Académie des Sciences, says a foreign exchange, M. A. Witte referred to the popular belief that aluminum was in general unacted on by acids as erroneous. The apparent inalterability of this metal is really due to the fact that in the presence of such reagents the metal clothes itself with a layer of alumina, thin, but continuous and impervious. When, however, steps are taken to remove this coating or to prevent its formation, aluminum is very readily dissolved by acids, as was to be expected from its great heat of oxidation. A solution of common salt and acetic acid acts on the metal pretty rapidly, the reaction being greatest near the surface, where atmospheric oxygen gets most ready access to the metal. The solution in question has the power of dissolving alumina, thus robbing the metal of its protecting coat and exposing its surface to fresh oxidation, which is dissolved in turn. A solution of sea-salt alone will act on the metal if oxygen and carbonic acid are supplied at the same time. Further, if a plate of aluminum, after immersion in sea-water, is exposed to the air without being cleaned, the corrosion will continue for an indefinite period.

An electrical engineer and manager of the corporation electric plant was recently appointed by the Shrewsbury, Eng., Town Council. There were 55 applications for the position. The salary is $1,250 per year.

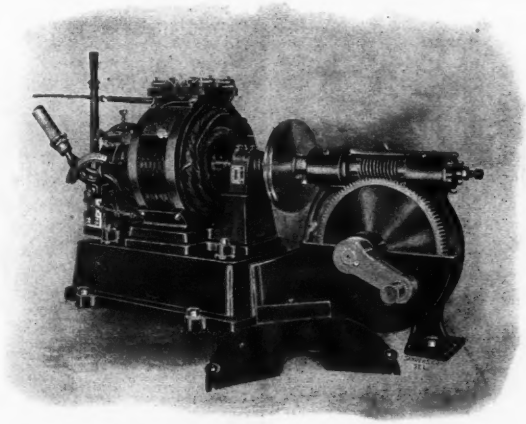
Preparations are being made by the Navy Department for the establishment of a school of electricity for enlisted men at the Brooklyn Navy Yard. It is proposed to train the former apprentices or men acquainted with a machine trade, so that a capable corps of qualified electricians can be organized.

Mr. Killingworth Hedges, C.E., of London, is at present in Southern India, where he has been asked to examine and report on the utilization of the water-power in one of the ghâts, or valleys, where it is proposed to run a light railway, to be worked, if practicable, by electricity, says our London namesake. Owing to the enormous expense of the Nilghiri rack rail mountain railway, which has not yet been opened for regular traffic since the disastrous landslip, the government are not sanctioning the use of state capital for other similar schemes. Mr. Killingworth Hedges considers that it may be possible to run a narrow-gage light railway on the existing mountain roads, and if sufficient water-power is available to work the steep gradient portion of the line electrically, it is hoped that the initial capital expenditure can thus be reduced, and that there will be a considerable saving in working expenses.

Mr. J. Hookey, assistant engineer-in-chief, has been appointed to the position of engineer-in-chief to the General Post Office at London. It is believed that Mr. Preece, who recently resigned as engineer-in-chief, will be retained as consulting engineer.

An electrician, who has a shop on Amsterdam avenue, in New York city, had tried unsuccessfully many ways to prevent tramps sleeping in his place at night, until he finally hit upon the idea of resorting to his trade for help. Accordingly, says the *Sun*, he rigged up a battery, and ran a wire from it to the door knob. Then he placed a push-button above the door, so that, when he wanted to enter the place himself, he could cut off the connection with the battery. Now, when the hobo touches the door knob at night, he receives a shock that dispels all thought of sleeping—at least in that locality. The electrician says that he is no longer troubled by somnolent visitors.

At a recent meeting of the trustees of Trinity College, at Hartford, Ct., it was decided to build a natural science hall at once, as well as to equip the Jarvis Laboratory with the most modern electrical equipment. Natural Science Hall will be built at a cost of $40,000.



AN ELECTRICAL ORGAN PUMPING OUTFIT.

The statue of Von Helmholtz, by Herter, has been finished. It will be placed in the court of the University at Berlin, between the statues of the two Humboldts.

The will of the late Jesse H. Bunnell, of J. H. Bunnell & Company, electrical manufacturers, of New York city, has been filed for probate. The estate, valued at $300,000, has been left to his widow and children.

A correspondent writes to the ELECTRICAL REVIEW that there ought to be a splendid opening for hustling electric light men to introduce isolated plants in Richmond, Va.

An electric railway mail service is to be established in Chattanooga, Tenn.

An Electrical Organ Pumping Outfit.

In the illustration presented herewith is shown an electrical pumping outfit, arranged for automatically pumping large organ bellows by means of either alternating or direct-current electric motors. The system was primarily designed for operation on alternating-current circuits, but its extreme simplicity, compactness, and the ease with which it can be installed, readily permits its use with any kind of current. The outfit consists of a single-phase, alternating-current motor of one-horse-power capacity, arranged with a triple worm-gear to directly transform the motion of the motor armature into the reciprocal crank motion required for an organ pump. In the case of the outfit shown the armature of the motor revolves 1,800 times per minute, giving through the worm-gear a crank speed of 45 strokes per minute. The apparatus eliminates all pulleys, belts, countershafts, etc., and is arranged to meet the exact requirements as to length of stroke and strokes per minute, which may be required to meet the needs of the various types of organs.

In this system the motor is started and left running (at a constant speed) while the organ is in use, and would be left running during an entire service or concert. The only disadvantage of this is the amount of current used while the pump is not in operation, and as this amounts to only 1.3 cents per hour on a one-horse-power motor with a rate of 10 cents per 1,000 watts, it will be seen it is a negligible factor, and is fully compensated for by the absence of extra current in starting several times.

The advantages of this system are quite numerous, the principal ones being the absence of regulating rheostats and sparking of contacts on stopping and starting, while the simplicity and compactness of the outfit speaks for itself.

The operation of the apparatus is as follows: The motor is started by the motor-starting handle, and, as the bellows of the organ is presumably empty, the friction clutch shown at

the other end of the motor shaft is in contact with the worm disk and the motor begins pumping air into the air reservoir until filled. The natural rise of the top of the air reservoir, to which a chain is attached through pulleys or bell cranks, will release the friction disk when filled to any desired point, and the pump mechanism will stop, leaving the motor running free, and thus taking almost no current.

As soon as the air reservoir begins to empty this will allow the clutch to operate again and supply as much or as little air as may be necessary to keep the reservoir full or well supplied with air.

The action of the friction disks is positive and noiseless. The worm is of hardened steel. The worm-wheel is run in a bath of oil, and is, therefore, perfectly lubricated at all times, and the entire outfit is designed and manufactured in a thoroughly first-class and workmanlike manner to stand hard and continuous service, with little or no attention.

The action of the apparatus may be controlled so as to pump fast or slow, and to change speed as the air reservoir fills by merely making a spring connection between the air reservoir and motor instead of a solid connection, but a solid connection is advised whenever practicable, as there is then very little or no wear on the friction clutch.

The Emerson Electric Manufacturing Company, of St. Louis, who are the makers of the apparatus herewith shown, are to be congratulated on their success in securing such compactness and simplicity in a device which appeals to a special field of its own.

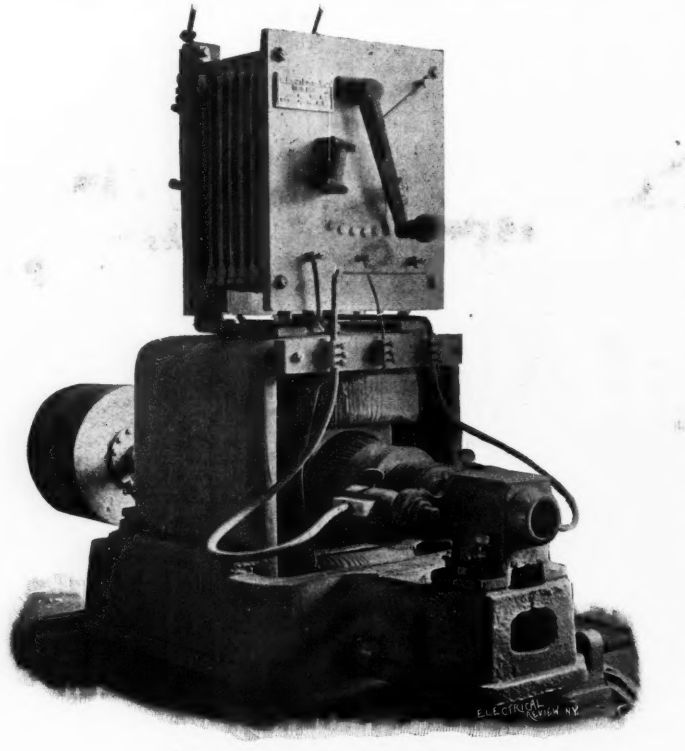
A Combined Motor and Rheostat.

The illustration herewith represents a novel and convenient arrangement of motor and rheostat as built by the Hobart Electric Manufacturing Company, of Troy, Ohio. The rheostat is fastened rigidly on top of the motor, but is thoroughly insulated from it.

There are numerous advantages claimed for this arrangement, which will commend it to a purchaser. It takes up less space than when the rheostat is away from the motor, and does away with all long wires connecting the two; furthermore, the connections are always made correctly, for this work is done in the factory and the motor tested before shipment. No local electrician need be called in, and the expense of complicated wiring is saved.

The main-line switch is placed on the back of the rheostat, and only two wires are brought to the machine. By having the switch and rheostat in this location the attendant is right at the machine when it starts, and can see that all is right in starting up.

Purchasers who have never seen an electric machine can install these as successfully as the most experienced engineer. The arrangement is made on both motors and dynamos, and, on account of the simplicity of both machines and arrangement, it makes this an outfit that should appeal to any one who is contemplating the installation of electric light or power.



A COMBINED MOTOR AND RHEOSTAT.

The New York & New Jersey Telephone Company's Annual Report.

The following is the annual report in full of the directors to the stockholders of the New York & New Jersey Telephone Company, of Brooklyn, N. Y.: Your board of directors has the honor to submit the following annual report of the operations of the company for the year 1898, together with a statement of its financial condition on December 31 of that year.

TREASURER'S REPORT, DEC. 31, 1898.

I. OPERATION.

GROSS EARNINGS.

Exchange		$1,047,983 39
Toll		664,071 97
Pay station		244,001 39
Private lines and leased instruments		27,048 23
Miscellaneous		37,228 10
Real estate		38,144 20
		$2,058,477 21

OPERATING EXPENSES.

General	$350,963 35	
Central office	323,660 77	
Maintenance	493,737 79	
Reconstruction	125,445 34	
Royalties	115,713 97	
Real estate	23,962 12	
		$1,433,476 34
Earnings over operating expenses		$625,000 87

FIXED CHARGES.

Interest on bonds	$67,838 19	
Taxes	54,187 06	
Interest on real estate mortgages	5,664 96	
		$127,683 21
Net earnings		$497,317 66
Dividends		315,622 00
Surplus earnings, 1898		$181,695 66
Surplus, January 1, 1898		1,528,646 95
Surplus, December 31, 1898		$1,710,342 61

II. RESOURCES AND LIABILITIES.

RESOURCES.

Plant	$6,356,754 18	
Equipment	657,786 79	
Real estate	809,711 50	
Material	283,384 76	
Accounts receivable	520,390 54	
Treasury stock	337,600 00	
Treasury bonds	19,000 00	
Cash	63,785 49	
		$9,043,413 26

LIABILITIES.

Capital stock	$5,000,000 00	
General mortgage bonds	1,374,000 00	
Real estate mortgages	121,500 00	
Vouchers	269,996 95	
Accounts payable	43,506 19	
Accrued interest	12,515 33	
Advanced charges unearned	41,092 18	
Stock subscription	238,900 00	
Reserved for dividends declared December, 1898, payable January, 1899	116,560 00	
Surplus, December 31, 1898	1,710,342 61	
		$9,048,413 26

III. COMPARISON.

	1898.	1897.	Changes
Gross earnings	$2,058,477 21	$1,790,287 21	$268,190 00 inc.
Operating expenses	1,433,476 34	1,236,819 89	196,656 45 inc.
Earnings over operating expenses	$625,000 87	$553,467 32	$71,533 55 inc.
Fixed charges, taxes, and dividends	443,305 21	381,725 66	61,579 55 inc.
Surplus from operation	$181,695 66	$171,741 66	$9 954 00 inc.

INVESTMENT — The balance remaining unpaid at the date of the last annual report upon the new issue of capital stock subscribed for in the preceding year was paid in during the first half of 1898.

In order to provide for further construction outlays authorized during 1898, and for the extensions in the company's plant during 1899, made necessary by its constantly expanding business, it was deemed wise to provide for a further increase of the company's capital stock. A special meeting of the stockholders was, therefore, held on October 27, 1898, at which the authorized capital of the company was increased from $5,000,000 to $8,000,000. The board of directors subsequently authorized the issue to the stockholders, at par, of $1,165,600 of the increased stock. The entire amount of this offering was subscribed for and payment will be completed during the present year.

The additions to the plant investment of the company during the year have amounted to $885,918.27.

The work of constructing the company's underground system in cities and towns has advanced largely, thus enabling it to render an ampler and more satisfactory service, while at the same time insuring for the plant a degree of permanency not possible in the case of overhead lines. During the year underground systems were inaugurated in Plainfield, Montclair, New Brunswick and Passaic, and large extensions were made to the underground systems in Newark, Jersey City, Paterson and East Orange. Satisfactory ordinances for underground work have been secured at Long Branch, Summit and South Orange, and the work in these places will be started during the coming year. Large as have been the extensions of the subway and cable systems of the company heretofore, your directors anticipate the necessity for further enlargements in this direction for several years to come.

The total number of stations operated at the close of the year is 22,065, a net gain for 1898 of 3,972, or about 22 per cent.

The steady increase in earnings from toll lines and pay stations during the year is especially gratifying, the amount earned from these sources in 1898 ($908,073.29) being $190,220.49 above that of the previous year. The total number of pay stations in the company's territory at the close of the year is 4,511.

REAL ESTATE—The increased investment of your company in real estate during 1898 amounts to $166,727.78. It is believed by your directors that to insure the safety and permanency of the plant, the company should own the buildings in which are located its principal exchanges in important cities and towns, and for this purpose several additional pieces of property have been acquired and the construction of new and fireproof buildings undertaken during the year.

The general office building at the corner of Willoughby and Lawrence streets, in Brooklyn, has been completed, and has proved admirably adapted for the accommodation of the various departments concerned in the general operations of the company.

A new six-story fireproof building is in process of erection on the company's property on Market street, Newark, which, it is expected, will be completed during the coming Summer.

A plot of land, with a suitable building thereon, has been purchased on Canal street, Newark, affording needed facilities for the storage of material and supplies for that district. New buildings have been completed at Paterson and Elizabeth, which will shortly be occupied by the main exchanges in those cities. At Plainfield and New Brunswick property has been purchased, and the buildings thereon altered to suit the company's needs. A lot has also been bought at Passaic, upon which a building is to be erected during the present year.

In the city of Brooklyn another fireproof building has been erected to accommodate the branch exchange which has been opened on Fifteenth street, and extensions are being made to the company's Throop avenue building to admit of the enlargement of the branch exchange located at that point.

COMPETITION — Competing telephone companies are in operation at Newark, Jersey City, Elizabeth, Paterson and Passaic, in New Jersey. There is, however, no evidence that these enterprises are making substantial progress. So far as your company is concerned, their establishment has stimulated, rather than retarded, the growth of its business. Sufficient evidence of this is perhaps afforded by the fact that, at each point where a competing company is established, your company has made a substantial net gain in stations since the commencement of the competition, greater than the total number of stations now in operation by its competitor.

Your directors believe that telephone service in a given locality can be rendered best by one company. The value of the service to the subscriber is in large measure dependent upon the number of stations which he can reach over the one system. The installation of competing companies involves, in the main, a duplication of plant and apparatus not necessary for the rendering of prompt or efficient service. Experience has shown that reasonable rates will be secured by the operation of natural laws of supply and demand, as well as dictated by the interest of good business management.

OUTLOOK—At the opening of the new year the prospect for the business of the company is in every way encouraging. The efforts which are constantly made by your management to extend and perfect the service are apparently appreciated by the public whom it serves, and the rapid increase in the volume of business and in the use of the company's facilities is in every way gratifying. With the renewed business prosperity, which seems now assured, your directors know no reason why the company should not be a full sharer in the improved conditions. Telephone service has long ceased to be a luxury, and is now a necessity of business and social life; the more widely extended its use, the more marked must be the ratio of its increase. It is the aim of the management not only to meet, but to anticipate, the public requirement for service; to provide facilities that are ample, to furnish a plant as perfect and complete as careful study and use of the best materials and apparatus can provide, and to render its service with such thoroughness and care as to merit the continuance of public approval.

It is the sad duty of your board of directors to record the death on January 11, 1899, of Mr. Joel C. Clark, the secretary of the company and a member of the board. Mr. Clark was one of the original incorporators of the company, and he has been prominently connected with its management since its organization. At a meeting of the directors, called to take proper action upon the matter, the following resolutions were unanimously adopted:

Resolved, That in the death of Mr. Joel Chessman Clark, who has been, excepting a brief interval, a director and secretary of this company since its organization, this board of directors has lost one of its most esteemed and efficient members, and this company an officer to whose zeal and industry it has been indebted in large measure for its establishment and success;

Resolved, That throughout our long association with Mr. Clark, the simplicity and sincerity of his character and his uniformly kind and genial manner have endeared him to us as a friend and associate, and commanded our respect for him as a man;

Resolved, That we express to his bereaved family our sincere sympathy in their affliction and our deep sense of personal loss.

Your directors acknowledge with pleasure the faithful and efficient service rendered by the employés of the company during the past year. The harmonious relations existing throughout all departments of the company have contributed largely to secure the satisfactory results attained.

By order of the Board of Directors,
CHARLES F. CUTLER, President.
New York, February 23, 1899.

The officers of the company are Charles F. Cutler, president; W. D. Sargent, vice-president and general manager; Waldron Hoppins, acting secretary, and Henry Sanger Snow, treasurer.

NEW ELECTRIC LOCOMOTIVE FOR THE CITY & SOUTH LONDON RAILWAY (OPERATED UNDER GROUND), SHOWING MOTOR ARMATURE UNCOVERED AND COVERED.

PENDLETON, IND.—The Pendleton Water and Light Company has been incorporated to operate waterworks and electric light plant; authorized capital, $5,000; incorporators, J. H. Brown, Geo. E. Mayer, B. O. Mayer, Chicago.

Electric Locomotives on the City & South London Railway.

The locomotive illustrated herewith is similar in general design to those already running on the City & South London Railway, and manufactured by Messrs. Crompton. It consists of a cab and under-frame, as shown, suitable for a four-foot eight and one-half-inch gage. The overall height above the rails is eight feet five and one-half inches; extreme width, six feet 10 inches, and overall length, from buffer to buffer, 14 feet two inches.

The chief points in which this locomotive differs from others is the fact that the three last locomotives supplied have been fitted with motors suitable for running with series parallel controllers. The motors in this particular case consists of four-pole machines with cast-steel magnets bolted in such a way that one-half can be removed for inspecting the armatures. The gun-metal brackets supporting the field magnets divide in a similar way. A view is also shown of the armature.

The locomotive is fitted with hand brake and Westinghouse brake, similar in all respects to the locomotives already owned by the company, but in addition there is an air compressor, consisting of a Brotherhood patent air compressor direct coupled to a Crompton enclosed motor. An automatic relay is connected up which starts the air compressor when the pressure in the storage reservoirs falls below a certain point, and stops the motor when the pressure exceeds about 80 pounds.

The armatures are of the ordinary Crompton traction pattern, mounted direct on the car axles, the cores being slotted, and the winding being of their well known "block" pattern.

The locomotive is constructed to draw the ordinary train, consisting of three coaches, but will draw four coaches if necessary. The speed of the locomotive is a good deal higher than the others on the line. It is obvious that the motors, therefore, are more powerful than those originally employed by the company.

Crompton & Company have recently received an order for 10 more locomotives similar in most respects to this one, but including certain modifications introduced by Mr. McMahon, the chief engineer to the company. We are indebted to our London namesake for the illustrations and the above data.

WILLIAMSTOWN, PA.—The citizens of this place are discussing the questions of building a water plant and electric light system.

Telephone News .....and Comment

The Farmers and Traders' Telephone Company has been incorporated at Fremont, Iowa, with a capital of $3,000.

Blake Brothers & Company have been awarded $150,000 New England Telegraph and Telephone five per cent bonds, due 1916.

The Evansville, Ind., Telephone Company, backed by Detroit capitalists, has abandoned the effort to establish an independent company at Evansville.

The Hudson River Telephone Company is introducing some improvements in its service, and at the same time offers reduced rental rates for long-distance telephones.

The Fordsville–Harrison, Ky., Telephone Company, of Ohio County, has been incorporated; the capital is $1,000. Ed. W. Ford, F. C. Cooper and J. T. Smith, Jr., are incorporators.

The Lincoln & Bristol, Vt., Telephone Company are about to reconstruct their Lincoln, Virgennes and Bristol exchanges. They will also build several new toll lines and small exchanges.

The Tilton & New Hampton, N.H., Telephone Company has sold its line to a new company, of which G. H. Davis is one of the principal stockholders. It is the intention of the new company to repair the line and put it in first-class condition next Spring.

The output of the American Bell Telephone Company, for the month ended February 20, was another record-breaker, and is as follows:

	1899.	1898.	1897.
Gross output.....	49,263	25,897	19,680
Returned.....	13,476	12,790	8,015
Net output	35,787	13,107	11,665
Since December 20:			
Gross output.....	95,811	51,758	34,117
Returned.....	28,195	22,831	14,416
Net output.....	67,616	28,927	19,701
Total outstanding..	1,192,862	951,180	793,550

The Commercial Automatic Telephone Exchange, which has the exclusive right in Connecticut to the Strowger Automatic Telephone Exchange system, has been formed in Meriden, with a capital of $250,000. The company proposes to establish the system which does away with the "hello girl" throughout the state. It will retain its headquarters in Meriden.

The following have been elected officers of the Troy, N. Y., Telephone and Telegraph Company: President, George P. Ide; first vice-president, W. C. Humstone; second vice-president, Alba M. Ide; secretary and treasurer, Herbert J. Richmond; executive committee, President Ide, Vice-president Humstone, C. H. Erwin, William S. Earl and C. Jay French.

The Corinna, Me., Telephone and Telegraph Company has been incorporated in Bangor. This line has, for its president, T. F. Burrill; for clerk and treasurer, E. McFarland, and for directors, the officers and A. McFarland. It proposes to operate a telegraph and telephone line between Corinna, Newport, Stetson, Exeter, St. Albans, Hartland, Ripley, Cambridge, etc.

The Mississippi Valley Telephone Company, which is putting in a telephone system in Minneapolis and in St. Paul, is reported to have been in the market recently for the loan of $500,000, presumably for the completion of its systems in the twin cities. In connection with its search for a loan a statement has been prepared in which the company's estimates place the value of its franchises at Keokuk, Burlington, Fort Madison, Muscatine and the twin cities at $1,500,000. The twin city franchises are valued at about $1,000,000.

A very curious case of telegraphic disturbance is reported from Utah, where the Oregon short line lost six telegraph wires for a distance of 80 miles north of Ogden, Utah, says the *Scientific American*. It was found, on inspection, that the cross-arms and insulators were heavily coated with salt, varying from one-sixteenth to one-fourth of an inch in thickness. This coating, when wet, taken in connection with the snow lying on the cross-arms, formed a dead cross. During the middle of the day, when the sun was shining brightly, the salt appeared to dry out and the wires could be used to some extent. When the cause of the trouble was determined an engine was started out equipped with a large hose, which was used with hot water for washing off the coating. The salt was carried by the winds blowing over the Great Salt Lake, and, as salt is a conductor of electricity, the short-circuiting of wires is easily explained.

ELECTRIC LIGHT FLASHES.

The property of the Seneca Falls, N. Y., Light and Power Company will be sold at foreclosure sale by the Old Colony Trust Company on April 8.

A Scranton syndicate is negotiating for the purchase of the Edison Electric Company plant at Pottsville, Pa. It is valued at $100,000, with nearly 100 stockholders. During the past 10 years the company has paid but one dividend, that was for three per cent last year.

The Monongahela Valley, Pa., Electric Company has let contracts for an increase of 800 horse-power in its engine and steam plants at Speer, Pa. It has also contracted for an additional increase in its electrical equipment of two 3,000-light incandescent machines and one 125-light arc machine.

The Montgomery, N. Y., Electric Light and Power Company to operate in the villages of Canajoharie and Palatine Bridge, and places within five miles of those villages, has been incorporated. Its capital stock is $25,000, divided into $100 shares, and the directors are Adelbert G. Richmond, Edward B. Burnap and James H. Cook, of Canajoharie.

The Greenville, Miss., Light and Car Company has secured the contract to light the city of Greenville with 60 or more arc lights, of 2,000 candle-power, for the term of 10 years, and has issued $40,000 of bonds for the purpose of adding to its present electric light business a small system of electric street railway, the construction of which it hopes to finish before July 1.

A big gas, electric and power combination has been formed in Paterson, N. J., to control all the gas and electric plants in the county and a few of those in Bergen County. The United Gas Improvement Company is at the head of the deal. All the lighting companies of Paterson, Passaic city and Lodi will hereafter be under one management, and the following have been chosen directors: William Bartsour, president; Garret A. Hobart, Bird W. Spencer, Hobart Tuttle, B. M. Shanley, John R. Lee, John W. Ferguson, E. T. Bell and Randall Morgan. The capital stock is $5,000,000, and bonds to the amount of $5,000,000 will be issued.

The Equitable Gas and Electric Company, of Utica, N. Y., of which Casimir Tag, of New York, is president, has been purchased by a party of New York capitalists. The latter have been represented by Anthony N. Brady, of New York. The deal was consummated and the 50 stockholders have sold their holdings at above par. The local company, whose stockholders are to some extent identified with the Equitable Gas Company, is capitalized at $400,000, and furnishes gas and electric light in this city. Beyond the statement that Mr. Brady was at the head of the new company no further information could be obtained. It is understood that former Governor Flower is interested.

The New York Gas and Electric Light, Heat and Power Company, of New York city, which was formed some months ago by the Whitney syndicate for the purpose of absorbing the electric light and power companies in Greater New York, has filed with the Secretary of State a certificate of an increase of capital stock from $25,000,000 to $36,000,000, to consist of 360,000 shares of $100 each. The certificate says that the amount of capital of the corporation actually paid in is $50,600, and the whole amount of its debts and liabilities is $36,150,956. The certificate is signed by Henry J. Hemmens, chairman, and Frank D. Allen, secretary, of a meeting of the stockholders called to act upon the proposed increase in capital.

Didn't Get "Asphalted."

General Manager Hurlbut, of the Norwich Gas and Electric Company, was startled one day recently by the hurried entrance of an excited Connecticut German, who exclaimed in much earnestness:

"Meester Hurlbut, Meester Hurlbut! The gas is leaking awful up to our house, and if you don't fix eet right avay, quvick, we'll all be asphalted!"

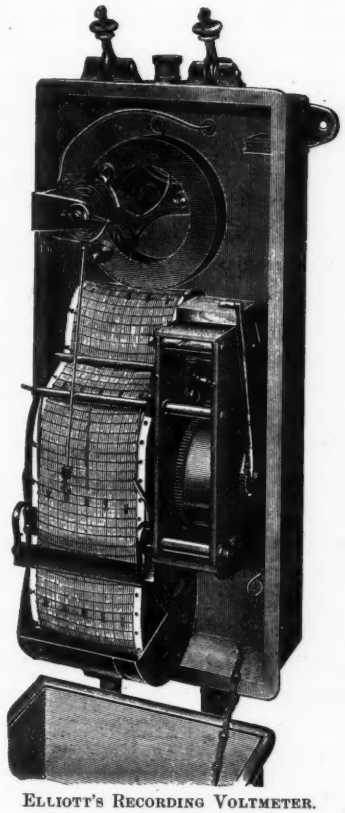
"Meester" Hurlbut rose promptly to the emergency and stopped the leak.

Toronto Electrical Firms Unite.

The amalgamation is announced of the W. A. Johnson Electric Company and the Toronto Electric Motor Company, Limited, both of Toronto, Ont. The new company will be known as the United Electric Company, Limited, and will have the following officers: W. A. Johnson, president; J. W. Thompson, secretary and treasurer; J. Norman Smith, engineer in charge of works. The new company will have a capital stock of $150,000.

Elliott's Recording Voltmeter.

We illustrate on this page a recording voltmeter, made by Messrs. Elliott Brothers, of St. Martin's lane, London, W. C. This firm makes two patterns of these instruments, one being intended for station use, while the other, which is fitted with a leveling device, is portable. The former is the one illustrated. It has an outer case of cast-iron, and the casting is an excellent specimen of the founder's art. The essentials of the instrument are the clock, which moves the paper under the recording pen, and the ammeter or voltmeter operating the latter. In the instrument illustrated this voltmeter consists, in the first place, of a permanent magnet, between the poles of which is a sphere of soft iron, which is supported on a bar secured to the framework of the instrument. The object of this iron sphere is to increase the magnetic flux. A ring of insulated copper wire surrounds this sphere passing between it and the magnet poles. This ring is mounted on pivots, and is constrained to occupy one definite position, when no current is flowing, by the springs shown. A long arm of aluminum extends from the arbor supporting the above ring to the paper on which the record is to be made, and is provided at its lower extremity with an aluminum pen which can be charged with any suitable aniline ink. The clock which, in our illustration, is represented with one of its cover plates removed, drives by friction a drum onto which the graduated paper is pressed by a spring presser. Holes perforated in one margin of this paper pass over studs on the rim of the drum, and entirely prevent any slip. The standard clock used in these instruments is arranged to feed forward the paper at the uniform rate of one inch per hour, but special movements are also provided giving a feed of three inches per hour, six inches per hour and six inches per minute, and these can be fitted at purchaser's option. The paper, after having passed under the record, is delivered into a sheet-metal receiver, shown at the lower part of the engraving, taken from London *Engineering*, where it coils itself up, and from which it can easily be removed for examination. The clock will run for eight days, and is wound by the lever shown at the side; there is thus no loose key to be forgotten or mislaid. Fresh coils of paper can easily be fixed in position. These coils are sold already wound on a wooden roller, having a hole at each end. These holes take center pins, mounted on spring bars secured to the frame of the recorder, and to remove an old roller it is only necessary to press back one of these spring bars. This done, the new roller can easily be put in position. The recording part of the instrument can, of course, be used for other measurements, besides those connected with electricity.



ELLIOTT'S RECORDING VOLTMETER.

Electrolytic Current Interruptors.

Davy records that when a current is forced through two electrodes of very unequal sizes, e. g., a wire and plate immersed in sulphuric acid, peculiar light and heat phenomena are observed at the smaller electrodes, says London *Engineering*. Planté, Chappuis, F. Braun, and others have studied these phenomena which Lagrange and Hoho first put to practical use. The variations in the light, and the humming noise, indicate that the current must be undulating, if not intermittent. That it really falls to zero has now been proved by A. Wehnelt. In his first electrolytic cell he simply dipped a bare platinum wire into the liquid. The spurting was so violent, however, that he constructed an L electrode consisting of a bent piece of glass tubing filled with mercury, and a short platinum wire fused into the horizontal arm of the L. When this small active electrode is the anode, as in the experiments of Lagrange and Hoho, it quickly melts off. When it was made the anode. Wehnelt could charge an induction apparatus with the help of his electrolytic cell, which takes the place of the current interruptor. At first he joined the cell in parallel to the condenser; but he soon noticed that the condenser was superfluous, and that his cell could be placed directly in his primary circuit of 60 accumulators. With this battery he obtained brilliant secondary sparks up to 50 centimeters in length. The number of current interruptions was estimated from the note given out by the sparks and also by stroboscopic observations; in some cases the number was higher than 1,500. The frequency increases with the electro-motive force of the primary current. A certain electro-motive force is necessary to start the phenomenon; this minimum electro-motive force depends on the size of the electrodes, the concentration of the sulphuric acid, etc. An incandescence lamp, put in shunt to the primary coil, lighted up when an electromotive force of 21 volts was reached; the lamp was for 56 volts; with 105 volts, two 110-volt lamps could be lighted when joined in series. Wehnelt recommends his electrolytic cells for Roentgen photography; the current remains steady, there is no flickering, and owing to the high frequency of the interruptors the exposition is shortened. Further, for experiments with Tesla coils, Hertzian waves, and for alternating current phenomena in general; supposing we have a transformer with 110 volts in the primary and a ratio of 1 : 10; the electro-motive force in the secondary would be 1,100 volts, but if an electrolytic cell is inserted in the primary circuit, the electromotive force will rise to 2,200 volts, as stated above. The current intensity increases with the surface of the electrodes, and the current can be regulated in this way without putting in resistance. But the number of interruptions decreases with increasing intensity. These electrolytic interruptors are certainly very simple.

Royce & Marean Sell Out.

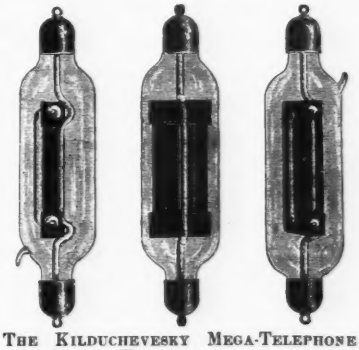
Royce & Marean, the well known electrical supply dealers, contractors and manufacturers, of 1,423 New York avenue, Washington, D. C., have sold their entire stock of electrical goods to the National Electrical Supply Company, who will continue the business at the old address. All liabilities of the firm of Royce & Marean have been assumed by Mr. M. Marean, and will be paid in full as soon as practicable.

The Kilduchevesky Mega-Telephone Transmitter.

The Kilduchevesky telephone transmitter is a microphone enclosed in a vacuum or in an inert atmosphere so that powerful currents can, it is said, be used without injury to the contacts, atmospheric moistures or other external causes of failure by which its efficiency might be impaired being excluded. The sealing of the microphone in a high vacuum or in an inert gas should apparently conduce to its uniform action and longevity.

The power of the current, it is stated, may be increased to any required extent without liability of oxidation of the contacts, as the latter are protected from moisture, dust and from derangement, and no packing can, it is said, occur.

The Kilduchevesky transmitter, we are informed by our London namesake, was successfully tested in Russia on overhead lines over distances up to 2,000 miles (a statement which is meaningless, as the gage of the wire is not given), and in England by Mr. A. R. Bennett, on an artificial cable equivalent to a length of about 200 miles, and having a resistance of 594.48 ohms and a static capacity of 59.73 microfarads, the resulting Kilduchevesky resistance being 35,508. With an ordinary double-pole receiver conversation of any description could, it is said, be carried on without effort.



THE KILDUCHEVESKY MEGA-TELEPHONE TRANSMITTER.

Though we are not inclined to accept the eulogistic conclusions which (as usual) are come to as to the future of the transmitter, there appear to be points in its construction which make it worthy of attention. The use of a microphone in a vacuum is, however, not, we believe, by any means a novelty.

LITERARY.

The March *McClure's* is an unusually good number of a magazine that never fails to supply something out of the ordinary. An account of Tripler's invention and process for reducing ordinary air to a liquid is the feature of the issue.

Electrical Review

[OLDEST ELECTRICAL WEEKLY IN THE UNITED STATES.]
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News, Subscriptions and Advertisements.

SPECIAL NOTICE TO ADVERTISERS.
CHANGES for advertisements must be in this office by Friday noon for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

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Two electrical editors again possess their own.

We hope to see the biggest as well as the smallest electrical development typified at the Electrical Exposition in this city next May. It should be a fitting exhibit of the greatest industry produced during the century so soon to end.

ELECTRICAL NEWSPAPER CONSOLIDATION.

The ELECTRICAL REVIEW's announcement last week of the proposed consolidation of the *Electrical World* and the *Electrical Engineer* was confirmed by subsequent publication in the contemporaries named. The title of the new weekly will be the *Electrical World and Electrical Engineer*—comprehensive but lengthy.

It is our belief that this amalgamation will be of distinct advantage to the vast and growing electrical industry. Under the intelligent methods of Mr. James H. McGraw, the publisher who effected the consolidation of the two properties, we expect to see the best journalistic factors continued and the unfortunate and disagreeable elements eliminated. The result should be a worthy and honorable competitor of the ELECTRICAL REVIEW, which will be welcomed by us with unfeigned satisfaction.

We have devoted the influence of this journal to the upbuilding of the best interests of the electrical field, never to tearing down either the industry or a contemporary. We believe this will be the guiding policy of the reorganized journal. We see only good for the developing science, and better service, journalistically, for the electrical public.

Perhaps it will not be deemed improper to acknowledge here the many, very many, kind expressions for our continued success that have come to us so spontaneously and so generally since the combination was announced. It is with full appreciation of the opportunity afforded us to realize, now more than ever, our ideal for an electrical publication, that the ELECTRICAL REVIEW is strengthening its technical and practical staff and increasing its financial resources And the indorsements referred to would seem to approve the wisdom of these added responsibilities.

The ELECTRICAL REVIEW, undisputedly the oldest electrical weekly, wearing the toga of achievement, independence and ancestry, with a parental "Bless you, my children," extends its cordial congratulations and sincere best wishes to its newly united contemporary and its staff.

AIR AND LIQUID AIR AND ELECTRICITY.

High pressure seems to have come down considerably in air-power matters, if we are to judge by the stock market gage. We adhere to the belief that these compressed-air schemes have a long row to hoe before they come to the goal of regular use. The electric automobile, meanwhile, whirls along the path of success in its own easy-going way.

Nor is there any present clear indication that liquid air will help the situation. No matter whether compressed or liquid air is used, the same handicap must exist favoring the electric automobile; namely, the type of motor. The electric system uses the ideal type of rotary motor with constant rotative torque, while the air motor is and, we believe, must continue to be of the reciprocating piston type, with all its mechanical complications and excessive friction. The only opening would seem to be in the direction of an air-turbine engine, along the lines of the Parsons steam turbine.

Signs of prosperity are becoming more numerous with the advance into Spring. A noteworthy sign is the voluntary increase of wages which many manufacturing companies are announcing from day to day. Within a few days heavy advances have been granted by many of the leading iron and steel manufacturers in various parts of the country. It can be safely assumed that the country is entering an era of prosperity beyond anything it has experienced for many years, and, as Congress has adjourned, we are not likely to have any national changes in the near future.

Some excitement in electric lighting circles in London seems to exist over the Nernst lamp. Without carbon in any form such a lamp would have a future if it can be made commercially practicable. We hear the criticism that it can never succeed if preliminary heating of the filament is to be required, whether by a match or a coil of platinum wire. But it is hard to think such an invention can not be improved and made all it should be.

STORAGE BATTERIES IN AN EMERGENCY.

An instance of the value of storage batteries in an emergency occurred in the Cushman Building, at the corner of Maiden lane and Broadway, New York, on February 27. This building, which is equipped with a battery of chloride accumulators, takes steam for its generating plant from the New York Steam Company.

Owing to a failure in the water supply the New York Steam Company's service was shut down at 2.15 P. M. The storage battery, which was not fully charged at the time, supplied current for the usual service in the building until 5 P. M., after which hour the number of elevator trips was somewhat reduced. The battery maintained the lamps throughout the night as usual, and steam was not used in the building until the next morning. It is fair to assume that the storage battery in the Cushman Building is a piece of apparatus that is popular both with the owner and the tenants.

Now that high-altitude meteorological observations are becoming more general, we may expect, before many years, the announcement of more reliable laws applying to weather conditions, and, as a consequence, greater accuracy in predictions, especially of sudden local changes in the weather. Electricity must necessarily be relied on in gathering and recording the data required to formulate any laws based on study of the conditions obtaining thousands of feet above the earth's surface.

PERSONAL.

Mr. John Dale, of the Dale Manufacturing Company, New York city, returned last week from a short visit to Havana.

Mr. S. Insull, of Chicago, president of the Chicago Edison Company, is a guest of the Windsor Hotel, New York, this week.

Mr. W. D. Sargent and Mr. H. G. McCully, two eminent telephonists, are recuperating in Florida this week, and contemplate a visit to Cuba before returning.

Mr. John F. Outwater, who is well and popularly known in electrical circles, has assumed the management of the New York office of the Shelby Electric Company, of Shelby, Ohio, manufacturers of incandescent lamps. Mr. Outwater has opened offices in the Fidelity and Casualty Building, 97 Cedar street.

Wall Street and the Electrical Stock Market.

Trade reports reflecting the general business of the country were never so good as they have been for the week just closed. The country's trade is unusually active, and there is an abundance of money. The financial outlook is still of the most encouraging character. All iron and steel products are advancing rapidly, and high prices for copper still prevail. In the stock market, as compared with last Saturday, the general run of prices is lower.

On the New York Stock Exchange, General Electric closed at 116¼ bid and 116½ asked, a gain of 4½ points for the week. Edison Electric Illuminating of New York closed at 194½ bid and 195½ asked, a loss of two points for the week. Metropolitan Street Railway, of New York, closed at 239 bid and 240 asked, a loss of 5⅞ points for the week. Third Avenue Railroad, of New York, closed at 215 bid and 216 asked.

On the Boston exchange American Bell Telephone closed at 347 bid and 350 asked, a loss of 8 points for the week. The instrument output of the company, published elsewhere in the ELECTRICAL REVIEW, is the best statement ever made by the company, and is a record breaker. Erie Telephone closed at 92 bid and 94 asked, a loss of two points for the week.

On the Philadelphia exchange Electric Storage Battery common closed at 128 bid and 129 asked, a gain of 12 points for the week. Electric Vehicle common was not quoted today. Union Traction closed at 35 bid and 35¼ asked, a loss of ⅞ point for the week.

Wall Street, March 4.

Important Cable Contracts Let in New York.

The preliminary contracts for about $400,000 worth of high-tension and low-tension feeder cables for the new underground trolley system of the Third Avenue Railroad Company, of New York city, were awarded a few days ago.

Three hundred thousand feet, 1,000,000 circular mils paper feeder cable was awarded to John A. Roebling's Sons Company. The contract for 80,000 feet of rubber-covered three-conductor No. 0000 high-tension cable was divided as follows: General Electric Company, 40,000 feet; Safety Insulated Wire and Cable Company, 20,000 feet, and John A. Roebling's Sons Company, 20,000 feet. The high-tension cable is to carry 11,000 volts alternating current.

As stated above, these are preliminary contracts. The amount of cable ultimately required is estimated at between $2,000,000 and $3,000,000.

IS THERE ANYTHING NEW UNDER THE SUN?

THE NERNST LAMP SAID TO HAVE BEEN INVENTED BY AN AMERICAN IN 1885.

The papers have lately had frequent notices of the great discovery made by Professor Nernst and its embodiment in a new incandescent lamp whose luminous conductor is free from carbon and other combustible material, but is simply a refractory oxide which will stand any temperature short of that of its own fusion, and requiring no vacuum globe.

Odd as it may seem, the idea is old, as the columns of the ELECTRICAL REVIEW will show. In the issue of November 5, 1892, page 132, was a full description of a new material for arc and incandescent lights invented by Lewis L. Jones, of Brooklyn, the patent for which had then just been issued, although the application had been filed in the Patent Office in 1885. The article described a material which was intended to take the place of carbon pencils and filaments, being composed, as the patent disclosed, of a mixture of "a non-conducting refractory oxide and a metallic or conducting oxide," thereby including the Nernst idea, but in a more practicable and available form. The combined oxides form a body which is a conductor *when cold*, and therefore does not need the assistance of any other source of heat to light up.

Mr. Jones in his tests used a mixture of 90 per cent of oxide of magnesium and 10 per cent of oxide of iron, which he says was well suited for the purpose, proving to be economical of current and giving a most brilliant light. Mr. Jones's luminant was tested at the old works of the Westinghouse company in Pittsburgh, and is said to have very successfully demonstrated its merit. For some reason unknown Mr. Jones failed to secure its adoption by any of the carbon or lighting companies, and he was not in that line of business himself. Feeling that he might be too far ahead, he concluded to let the invention wait till the developments caught up with it.

Later the work was taken up by Mr. T. J. McTighe, electrical engineer, who had been familiar with Mr. Jones's invention in 1889 and 1890. Mr. McTighe had been engaged later in some work in the field of incandescent gas lighting, and was led to believe the Jones idea could be improved by the use of the more refractory mixtures used in the Welsbach mantles. The belief proved well founded, and with other improvements both in material and form, Messrs. Jones and McTighe expect soon to bring out a self-lighting incandescent lamp of remarkable efficiency.

When an existing lighting station with a capacity for 10,000 carbon lights can wire and operate 20,000 oxide lights with its present power and generator capacity, and without consuming any more coal, the electric light manager can only rub his hands in glee, and this is what these gentlemen expect to be able to accomplish.

Telegraph Operators' Breaks.

TO THE EDITOR OF ELECTRICAL REVIEW:

Under "Views, News and Interviews" in ELECTRICAL REVIEW, Vol. xxxiv, No 9, I notice several amusing breaks of telegraph operators, to which the following might be added.

Having charge of a private telegraph office I one day received a message reading: "Please send me my excat at once." Wondering what an excat looked like, I asked the man at the other end: "Did you ever see an excat?" "Never in all my life," was his reply. The party to whom this message was addressed being an editor, I surmised the "office cat" as being the creature in question; but was not satisfied with that explanation and substituted *exeat*, the only word in Webster's Dictionary which had any resemblance to *excat*, and that was what was wanted.

"Tell that fellow," the charitable sender remarked on being told about the "bull," "to go to some primer school and not apply for his exeat there till he is able to distinguish c from e."

Yours respectfully,

SUBSCRIBER.

St. Paul, March 3.

The New York State Railroad Commission has approved the increase in the capital stock of the Manhattan Railway Company, of New York city, from $30,000,000, consisting of 300,000 shares of $100 each, to $48,000,000, to consist of 480,000 shares of $100 each. The company says that the proposed increase is to provide funds for the necessary plant and equipment involved in a change of motive power from steam to electricity. The company says that the whole amount of its debts and liabilities is: Bonded debt, $39,591,035; net floating debt, including $458,595 interest on bonds accrued, not due, $2,436,920; taxes charged to operating expenses and now in litigation, $1,219,258.

A Forecast of the General Electric Company's Annual Report.

Copy for the forthcoming annual report of the General Electric Company is now in the hands of the printer. The ELECTRICAL REVIEW is informed that the report will show a gross business of about $17,500,000, with fixed charges and operating expenses of $14,500,000. This leaves a balance of $3,000,000, which is equivalent to about 15 per cent earned on the common stock.

From another source it is stated that the company has in bank at the present time upwards of $3,000,000 in cash.

At the annual meeting in May it is predicted that the announcement will be made that a dividend of one and one-half per cent quarterly will be paid on the common stock.

Telephone Progress in Michigan.

President Charles J. Glidden, of the Michigan Telephone Company, who has just returned to Detroit from a business trip to Massachusetts, says that, since February 1, five hundred new applications for telephones had been received by the company in Detroit.

"Subscribers are coming in so fast that we are 1,000 behind in making connections," said he. "This delay is due partly to the extremely cold weather and in part to the slowness of the arrival of material. We have purchased 100,000 telephone poles in Michigan, and with them will put up about 3,000 miles of poles. On these and those already located we shall string about 19,000 miles of wires in Michigan."

New Officers for the Consolidated Street Railways of Baltimore.

The United Railways and Electric Company, of Baltimore, Md., which was recently formed to take over and consolidate all the street railways in Baltimore, held a stockholders' meeting on March 4, at which the following officers and directors were elected: President, Nelson Perin; vice-president, Walter S. Franklin; general manager, Wm. A. House; treasurer, Briggs C. Keck; secretary, H. C. McJilton.

Directors: Nelson Perin, Alexander Brown, E. L. Bartlett, Walter S. Franklin, W. B. Harvey, Geo. C. Jenkins, Seymour Mandelbaum, Henry A. Parr and Geo. R. Webb.

Mr. W. T. Bouchelle, who is prominently connected with the New York Telephone Company, has been elected a director of the New Amsterdam Gas Company, of New York city.

NERNST'S ELECTRIC LIGHT.

READ BEFORE THE SOCIETY OF ARTS, LONDON, FEBRUARY 8, 1899, BY JAMES SWINBURNE.

(Concluded from page 145.)

If the carbon has the same specific resistance, the relation between pressure and length is $E = L^{\frac{3}{2}}$ and $E = D^{-\frac{3}{2}}$. If the filaments are flashed, the proportions will be still more extreme. The question of high pressure incandescent lamps is thus—How far can we make the filaments longer and thinner and flimsier without exasperating our consumers? Unfortunately the consumer is rapidly getting saddened as it is. The 100-volt eight-candle-power lamp does not please him much, and the 200-volt eight-candle-power lamp has in no way delighted him; if the lamp is made with two 100-volt filaments in series, it combines the disadvantage of both, without the advantages of the small candle-power of either. But it adds some further disadvantages peculiar to the higher pressure which I have not so far touched upon, and that is that the higher the pressure the more troubles there are through the silent discharge, or whatever it is called. I need only refer to the well known experiment, in which a third terminal is sealed into the lamp. A galvanometer then shows a current going across country inside the lamp. This is no doubt intimately connected with the life, or rather with the death, of the lamp.

I have dealt with the question of high-pressure incandescent lamps at some length because the subject is really of vital importance, and is too much neglected. Our technical colleges, and our technical press, and our technical societies pay the greatest attention to questions of a per cent or two in the efficiencies of dynamos and transformers, and give a good deal of attention to engines and boilers. That is because there is plenty of room for calculations in connection with these subjects; but the incandescent lamp, which at present holds the whole career of the lighting industry in the little curl of flimsy red-hot carbon that can hardly support its own weight, receives no attention at all. How much does the average electrical engineer know about incandescent lamps? The only subject that is treated in the same way is the cable. About half the money in town lighting goes in the cable, a mere fraction in the dynamos and transformers themselves; so the average electrical engineer knows nothing about cables.

So far I have only discussed the incandescent lamp; the arc lamp has also to be considered. I will not say much about the arc lamp just now, but will add a little more when the Nernst lamp is compared with it. The ordinary arc is limited in pressure to about 50 volts, including the series resistances necessary for regulating. The enclosed arc is a new development, which is more satisfactory as regards pressure and as regards consumption of carbon.

The lamp I describe to-night is the invention of Professor Walther Nernst, of the University of Göttingen. Though he is a young man, Professor Nernst's name is already known to all modern chemists as a leading authority and original thinker in the field of physical chemistry. It is unusual for a man who has climbed to the top of one tree to jump to the top of another.

Nernst's, like most great inventions, is exceedingly simple as soon as it is understood. The efficiency of an incandescent body, as far as radiation goes, depends simply on the temperature. The efficiency of an incandesent lamp, for instance, depends on the temperature of the filament only, providing there is no loss by convection. The carbon will not stand a sufficiently high temperature, especially as, in addition to its low specific resistance, the filament has to be long and slender, and thus weak. Nernst, therefore, chose a material that would stand higher temperatures than carbon, and his material has the incidental advantage that its specific resistance is so high that strong rods can be used for high pressures instead of thin filaments. The most refractory materials so far used in lighting are zirconia, which has been used to replace lime in the limelight, and the oxides, or so-called rare earths, in the Welsbach mantles. I am aware, of course, that many people suppose that the Welsbach mantle is not very hot, treating it as if it were at a temperature, for instance, below the melting-point of platinum. The light emitted is supposed to be due to some special power of selective emission due to the oxides employed. I have had a good deal to do with incandescent gas mantles, and I find no reason to suppose there is any magic effect of this sort going on. The part of the flame where the mantles hang fuses platinum wire easily, and very few materials can stand the temperature without fusing or volatilizing. Lime and many other oxides volatilize slowly from the mantles. I do not mean that the mantles are above the boiling point of lime. I have some idea of its melting point, as I have made a few pounds of melted lime and run it out on the floor to look at it. The Welsbach mantles, which are now chiefly thoria, are at a temperature near their softening point, and in the making are raised to a temperature at which they begin to soften.

Nernst takes highly refractory oxides as his material. It does not seem promising, because such oxides are notoriously good insulators; but such insulators are electrolytes when hot. Nernst therefore heats the rods to make them conduct, and then heats them electrically, preserving a temperature which is within the limits that the material can bear without softening. This means that he can take the most refractory bodies supplied by the whole range of chemical research and can heat them to a temperature short of their softening point, and can thus get an efficiency unknown to workers on the incandescent lamp. Such efficiency also means whiteness of light so long as the efficiency is not too high. Thus the crater of the arc, being at a temperature of boiling carbon, gives a light that is unpleasantly blue.

The material is worked up into little white rods. Each rod is mounted on two platinum wires, a little paste made of refractory oxides being applied to the joints. The little rod with its two wires is then mounted in a holder, which fits ordinary electric light fittings. As the rods fall in resistance as the temperature increases, after the manner of electrolytes, an increase of current produces a decrease of resistance. This tends to give some instability in running in parallel on supply circuits. This instability is corrected, as in an arc lamp which has analogous properties due to a different cause, by a series resistance. The Nernst rod has, therefore, a resistance in series. This is made up of exceedingly fine wire, and for ordinary circuits amounts to 10 or 12 per cent of the whole resistance of the lamp. The consumption, including the resistance, is 1.5 watts per candle for large lamps and 1.6 for small lights or low pressures. In small or low-pressure lamps the loss of heat at the ends is larger in proportion.

Such a lamp as I have described will not light up of itself, for the rod is an insulator when cold. The simplest way to start it is to warm it up with a match or, better, with a small spirit lamp. Such a lamp as this is not only very cheap as regards first cost, but very economical in running. The life of rods running at an efficiency of two-thirds of a candle per watt, including the resistance, is already more than 500 hours in good specimens. If the Nernst lamp advances as much in the first few years of its existence as the carbon lamp did between 1880 and 1882, it will soon be made so well that the rods last a lifetime. When the rod is worn out a new rod with its wire mounts is all that is replaced. The whole lamp is not thrown away at all.

The method of lighting I have described, though it may be used in many cases, such as large public rooms, is really a savage mode of ignition, fit only for dealing with uncivilized commodities, such as gas and tobacco.

The small lamps and the lamps of medium size are in practice started by a heating resistance. This is arranged close to the rod and in shunt to it. As soon as the rod is hot enough to conduct, its current works a tiny cutout in the resistance circuit. In large lamps the heating system is a little more elaborate, as the resistance arrangement is arranged as a sort of hood which covers the rod. As soon as the rod conducts, not only is the resistance circuit broken, but the electro-magnet lifts the little hood clear off the rod. In all these forms the rod and its mounting are replaceable without interfering with the rest of the lamp.

We now have to consider the part the Nernst lamp is probably going to play in the near future.

Compared with the small incandescent lamps, as you deal with a material of much higher specific resistance, it is easy to give both small lights and high pressures. The question of lighting is exceedingly important, though it appears trifling at first sight. People are so accustomed to lamps being turned on from the door without any further trouble that they will generally object to having to light them with matches or spirit lamps, but there are many cases in which it will be quite satisfactory to have one lamp with an automatic lighter to show you the way into the room, the rest being lighted with matches or a spirit lamp as needed. There will be, however, a considerable opening for the cheap, small-power, high-efficiency lamp; and the disadvantage as to lighting is small in such cases as cafés, restaurants, churches, hotels, railway stations, and in short in most public rooms.

Coming now to the next size, that is to say, lamps of 20 to 200 candle-power, and even small lamps in which it is worth while to have automatic ignition, the first cost of such lamps will be higher than the first cost of incandescents, but as the rod itself has alone to be replaced, that is a matter of very slight importance. This size of the Nernst lamp has, further, every chance of completely ousting the carbon incandescent on the score of cheapness, as to renewals, higher efficiency, better colored light, and perhaps more especially high pressures. Once the Nernst lamp becomes so general that systems of distribution are laid out to suit it, instead of to suit the carbon lamp, the carbon lamp is practically "out of the running." It must be remembered that the Nernst can compete with the carbon filament at any pressure that suits the filament, but the Nernst lamp can easily go right out of the depth of the filament and have the higher pressures to itself. It must be remembered that at present the cost of cables in a system of distribution is an exceedingly large item.

Turning now to the large lamps, they compete with the arc lamp in efficiency. Of course the efficiency of the arc lamp is not a very definite quantity. The candle-power is generally determined by multiplying the current by two and adding zeros at discretion. All I can say is that, however many zeros the good nature of the maker may supply, a Nernst lamp taking the same power gives a better light. When carefully arranged on the photometer the arc may be better in given directions, but a lot of light given in directions that you do not want is not the same as the same light distributed with a uniform spherical emission. The arc lamps shown here will give the audience a good idea of the relative values. The Nernst gives a pleasanter and

of course a perfectly steady light. Coming to costs, the Nernst will be very much cheaper in first cost, but enormously cheaper in maintenance. It also goes quite away from the arc as to pressures. There is no trouble for instance in making large lamps to work in parallel at 500 volts and by using double rods at 1,000 volts. This puts an entirely new development of electric lighting in the hands of the engineer.

There is one point I have said little about yet. The incandescent lamp which is still with us gives trouble, not only because of the low pressure it needs, but also because it demands that the pressure shall be kept uniform. It seems quite possible that the Nernst lamp may be made to stand a much greater variation of pressure than the filament. If this proves true it means an enormous difference in the designing of distribution mains. I do not like to say much about this yet, as the invention is too young and too little time has been available to make much certain progress in that direction. Results are promising, but it is best not to be sanguine.

It is difficult to discuss an invention like this without being carried away by enthusiasm. I feel, however, that I have but feebly shown forth the probable future of what seems to me the greatest invention in electric lighting that we have seen for many years. Still I am sure I have not been too sanguine.

DISCUSSION.

Professor Ayrton, F. R. S., said: The knowledge that an insulator could be made to conduct electricity by heating it was much older than the recent experiments of Sir W. Roberts-Austen, for some 23 years ago a paper appeared in the Transactions of the Royal Society on that very subject of the extraordinary diminution of resistance in a solid electrolyte by heating. It had also been known ever since carbon filament lamps had been on the market that there were certain difficulties connected with them, and many experiments had been made, and patents taken out with the object of using refractory earths, but apparently no one before Professor Nernst had thought of the simple expedient of heating a very good insulator with a match or spirit lamp, applying a current of suitable potential, and thus obtaining a brilliant light, such as they had now seen for the first time. This result was clearly of enormous commercial importance, and would be an entirely new departure in glow-lamp electric lighting. Some five or six years ago he asked an assistant of his to look up the literature on the subject of the Welsbach burner, and see if any report had been made throwing any light on the question whether the effect of the burner depended solely on the high temperature. He gave him a reference to a German paper in which experiments were quoted, which seemed to show that the high temperature was not the sole factor. Later on he discussed the matter with a very distinguished English chemist, who agreed in the view that it was not solely a question of temperature, and a year or two afterwards he again discussed it with Prof. Elihu Thomson in America, who took exactly the same view. Many people thought

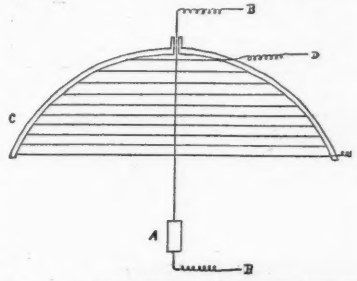


FIG. 1.—DIAGRAMMATIC REPRESENTATION OF THE NERNST LAMP.*

that the material of which the mantle was made had the power of absorbing oxygen from the air or the gas, and compressed it, much as spongy black absorbed hydrogen and oxygen, and so caused these gases to burn under considerable molecular pressure. It was not merely that the Bunsen flame raised the material to a high temperature, but that the gas and air were compressed together in the pores of the material, so that the gas was burnt under pressure, and so you got a much higher temperature than you otherwise would. In the glow lamp, as they were not dealing with gas, it did not seem that the materials could play any such part. There seemed to be something in that idea because it was necessary for the mantle to be a certain exact composition; you could not take thoria or zirconia at random and use it; you must have a certain definite combination to produce an efficient mantle. In fact it was the addition of 0 4 per cent of ceria which converted the Welsbach burner from a ghastly failure commercially into a wonderful success. He should like to know whether the mantle was not at a much higher temperature than the flame which surrounded it, and whether a particular combination of materials did not reach a much higher temperature than another combition immersed in the same flame. If so, it was not merely the temperature of the flame which produced the result. There was one great advantage about the Nernst lamp; it did not seem to require a thin glass bell and a vacuum, and thus got rid of a very serious difficulty, because these bulbs were very fragile, and were easily destroyed by a touch of a broom or carelessness in carriage; many lamps also were defective, not from any fault in filament, but because the vacuum was imperfect.

Mr. Hiram Maxim said he had always understood that the light in the Welsbach burner did not depend entirely on the temperature. There were many things in nature which gave light without any heat at all; such were glow-worms and fireflies. His opinion was that any substance, if there were any, which did not volatilize at all, would give a light proportionate to the temperature; that platinum, or iridium, or iron, if the iron was not burnt, would all give the same light at the same temperature, provided none of the material was wasted. Of course, if the least particle passed into the air the flame would be colored. In all probability the light emitted did not increase as the temperature directly, but as the square; some said as the cube, and some said as the fifteenth power of the temperature, and he was inclined to think that a slight increase in temperature increased the lighting power a great deal. In the Welsbach burner the light was not white, and that, he thought, indicated that some change was going on which made the apparent light higher than that due merely to the temperature. If carbon were heated to the same temperature it would not give the same light.

Mr. W. M. Mordey thanked Mr. Swinburne for speaking the truth about the 200-volt lamps. The supply of lamps was a matter which really required attention, because it led to a great deal of dissatisfaction. He thought the correct plan would be for the companies to supply not electricity, but light; and instead of persuading customers to buy lamps of any particular kind, they should make an inclusive charge, and supply them with lamps themselves; this would prevent dissatisfaction. He congratulated the society on this paper, which he thought would mark a new epoch

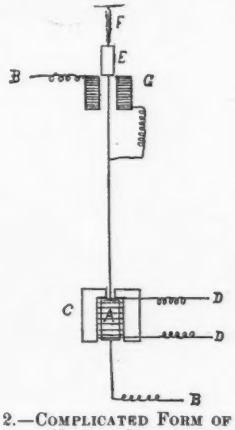


FIG. 2.—COMPLICATED FORM OF THE NERNST LAMP.*

in electric lighting; it was the first page in a new volume, recording an invention which would rank with that of the Swan lamp, since which there had been nothing brought forward so pregnant with results. They must also congratulate Professor Nernst on his invention, and take care that he had the credit of it, and was not robbed by a number of people, who would be immediately writing to the *Times* to say that they did the same thing in their back kitchen 20 years ago. That was what always took place in the case of a new invention. Mr. Maxim had anticipated what he was about to say about the glow-worm. Professor Langley, in America, dealt with the radiation from fireflies and glow-worms in a paper a few years ago, and gave a diagram showing the total radiation, and what proportion was luminous; the result proving that the glow-worm had solved the problem which Tesla, Hertz and many others had been working at, of making nearly the whole of the rays luminous. If they could only get a glow-worm to come and read a paper explaining how it was done, Dr. Nernst's lamp would have no future before it. One advantage these lamps possessed was that they would be able to light their cigars and pipes at them. He agreed with Mr. Swinburne that the possibilities of the carbon filament were about exhausted; there had been very little improvement for a long time, and it was a remarkable thing that just when the carbon filament was failing to meet their requirements, this new invention should be made, which seemed to meet the case. It was like the discovery of gutta percha at the critical period, which got electric cable-makers out of their difficulties. But, though the new lamp was evidently a very robust child, it was still a child, and it would at any rate take a little time to displace existing lamps. If lamp companies' shares went down at all on account of the Nernst lamp, he would like to buy some, as they would have time to rise again before the incandescent carbon disappeared.

Dr. Fleming asked if there was any deterioration in the quality of these lamps after a time, such as occurred with carbon filaments and Welsbach mantles; because this would be very important in considering the commercial value of the invention. If the lamp only required one watt or one and one-half at starting, and, after a few hours' work, four or five, it would be a serious disqualification. It was well known that most of these radiants did deteriorate after a time; with the lime-light, for instance, after a few minutes, the radiant quality of the lime diminished, although it was played upon by an oxy-hydrogen flame at a constant temperature; and turning the lime round would markedly increase the amount of light on the screen.

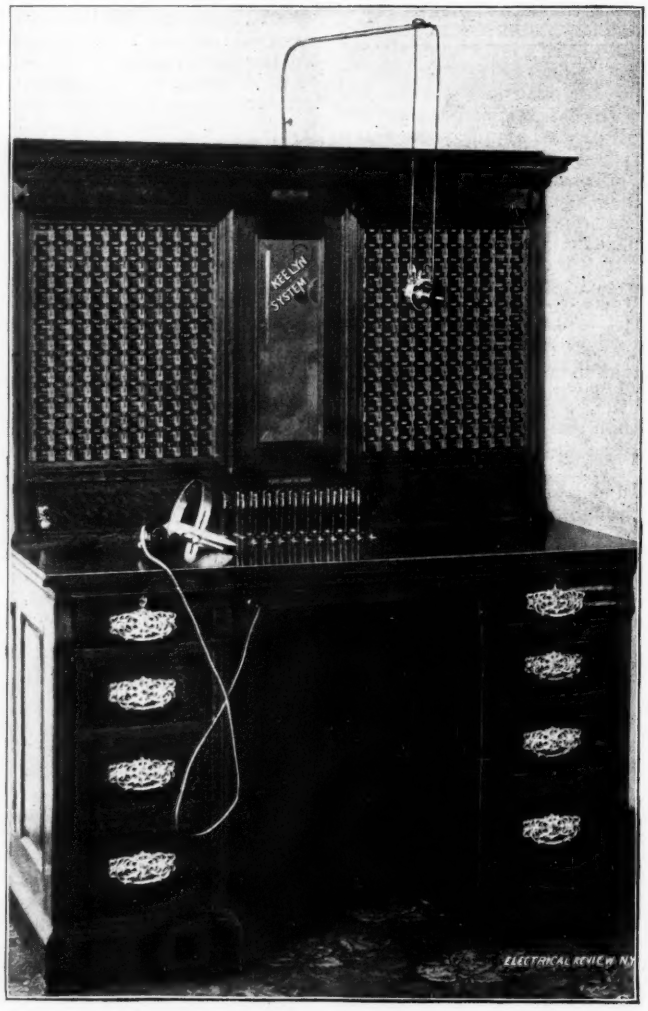
Mr. H. Colefax said several applications for patents had already been put in, which appeared to claim the benefit of this discovery, but he did not think they would prove successful. With regard to the question of deterioration, he was told by Professor Nernst, some eight months ago, that as far as he could discover, these lamps did not deteriorate in use; of course, this could only be proved by experience, but if it were so it would be very remarkable, seeing that in every other form of incandescent lighting yet tried there was this deterioration. He should be glad if Mr. Swinburne could tell them what it was which limited the life of the filament, because when he saw Professor Nernst, he did not think he

* Reproduced from the ELECTRICAL REVIEW for November 23, 1898.

had then arrived at any explanation. He was astonished at the progress which had been made in the eight months since he first saw the invention; the limit then was 200 hours, the first experiments only having attained 40 hours.

Mr. Campbell Swinton said Professor Ayrton was not strictly accurate in saying that this was the first attempt to use a heated electrolyte. Some 20 years ago Jablochkoff showed a lamp in London consisting of a strip of kaolin, along the top of which he put what he called a match, which consisted, he believed, of carbon mixed with treacle; this conducted the electricity—100 volts—until it heated the kaolin, and that then formed the conductor. He would not go into the question of how far that was an anticipation of the present invention; he only wished to correct the impression that nothing of the kind had been tried. They must all admire the great advance which had now been made, and they knew that the Jablochkoff lamp never came to anything. With regard to the lighting power of incandescent gas mantles, he had made many experiments on them with cathode rays, by which you could heat them to a very high temperature without the use of gas in the ordinary sense, and he found there was no appreciable difference in the amount of light given by a mantle of pure thoria, and one with the addition of a small percentage of ceria.

Mr. Swinburne, in reply, said the question of the temperature of a Welsbach burner was a very large subject, with which he could not attempt to deal fully. If you examined a burner with the mantle off there was a zone of very high temperature, which would easily fuse platinum; but most measurements made were erroneous, because they were taken with a thermo pile, which never got the real temperature of the burner; the great difficulty was to get what was in the burner to the temperature of the burner. In dealing with the light given by incandescent bodies it must be remembered that the light depended on the emissivity. If the only temperature at which you got much light was very high—very close to the temperature of the gas—you must use something of very low emissivity; if it were large the heat given by the burner was rapidly given off, and if infinite the temperature of the mantle would remain at the average temperature of the room, and you would not get any light. On the other hand, if the emissivity were very low, though the mantle would get to a high temperature, it would not give light for want of emissivity. A pure white body, such as pure zirconia, gave very little light, because the emissivity was too low, though the temperature was high. To get the highest efficiency you must have emissivity enough to give plenty of light without robbing the flame of its heat too soon. From a white oxide like thoria you did not get much light, but if you added a small percentage of ceria or some other colored oxide—it did not matter much what—you got light. A great deal of unnecessary mystery had been introduced into the subject because it was known that erbia gave some curiously characteristic spectra, but erbia was only present as an impurity. Another point was that cerium had two sets of compounds, and it was supposed that it was continually hopping backwards and forwards from one state of oxidation to another. In dealing with a subject like this, he thought the proper way was to take a simple explanation if it fitted the case, and only if it did not go to a more complicated one. He saw no reason to suppose that temperature did not account for the results, if it would fuse platinum, and if it would soften the mantle, as it would. In making Welsbach mantles—though having advised the company he must not say everything he knew—they were sometimes raised to such a high temperature that they softened, and then they gave more light. Professor Ayrton had quoted several anonymous authorities, but had not given the reasons for their opinions, and so it was impossible to deal with them. They involved questions of thermodynamics into which there was not time to go. The case of spongy platinum was altogether different; there was a chemical combination started by the heat, which would not otherwise take place. Here there was no reason to suppose there was such a combination; spongy black would give no light, and a solution of platinum put upon a mantle would destroy its light-giving power. He believed that color was largely a question of temperature; but you could produce different colors by using different materials. The emission was the complement of the absorption. A blue body when heated gave an orange light. With regard to a vacuum, its effect was to get rid of convection. If you tried to heat a long thin filament of carbon, it would be inefficient on account of convection; but with a short, thick rod the convection was not serious. Practically he believed these Nernst lamps would not work in a vacuum. He had not tried many experiments himself, but so he was informed. The reason generally given was that electrolysis was going on, and that oxygen was being absorbed from the air at one terminal and being given off at the other. That was Professor Nernst's explanation, but he thought there was another factor to be taken into account. It was perfectly simple on paper to electrolyze salt, and get out chlorine and sodium, but when you tried it you did not get either. The reason appeared to be that the chlorine and the metal were dissolved to some extent in the fused bodies, and got across very quickly. He did not think true electrolysis took place to any extent, but there was a continual diffusion of the substances across which was undoing the work of electrolysis all the time, but that was not sufficient to make it work properly in a vacuum. All the lamps shown were on the alternate current, but he had tested them with the direct current and found their efficiency continued right through. That was some six months ago, when they lasted 200 hours; now they had got to 500 hours, and he had no doubt they would go much higher. He did not know anything about glow-worms, and doubted whether any one else did; but he did not think such questions had much to do with the matter; it was more a question of the red-hot poker order, quite simple. With regard to the emission of light at a given temperature, it was not the least likely that there was any such simple law as Mr. Maxim had suggested. The simple law would be as to the emission of power or energy. Light was only a certain small octave of vibrations that affected the human retina, it was not distinct from heat, or the radiations of still higher frequency. It was not likely there was any definite law as regarded light; probably it depended, for one thing, on the eye looking at it.



TELEPHONE SWITCHBOARD FOR A LARGE NEW YORK OFFICE BUILDING.

Telephone Switchboard for a Big New York Building.

The illustration herewith shows a new 300-capacity central energy switchboard which is to be installed in the new Park Row building, New York city. The board was manufactured by the Western Telephone Construction Company, of Chicago, and is one of the finest of its kind ever installed in any exchange. The exquisite cabinet work, which is of the finest antique oak, was made in the company's own factory. It is embellished with handsome light bronze and heavy nickel trimmings. The board is equipped with the "Western Express" metallic circuit combination drops and jacks and swinging-arm transmitter. The center of the board contains a heavy bevel plate mirror and is ornamented with the words "Keelyn System." It is handsome and durable and was especially made for this new building, the contract being awarded to the manufacturers over many other competitors. This company also furnished the equipment for the Waldorf-Astoria Hotel. The latter has been in service more than a year, giving, it is said, the best of satisfaction.

A St. Louis Telephone Company.

Herewith are shown a view of the building and an interior view of the office of the Central Telephone and Electric Company, of St. Louis. The company are well located at 1123 Pine street, and occupy the entire building for manufacturing work in telephone construction. Because of their western location they command the attention of a large field and their exchange instruments and intercommunicating installations are found in many western cities. This company are now getting from the press the second edition of their catalogue, which will include many types of instruments and telephone parts, which they will be glad to send to applicants.

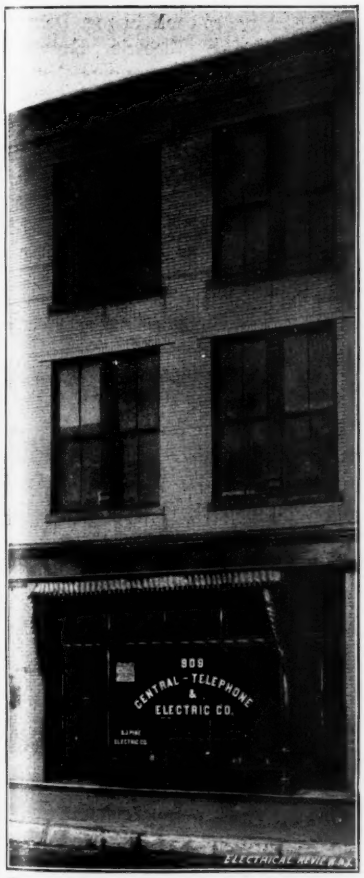


FIG. 1.—EXTERIOR VIEW OF THE CENTRAL TELEPHONE AND ELECTRIC COMPANY'S BUILDING, ST. LOUIS.

New Electric Light Company In New Jersey.

The Bergen & Passaic Light, Heat and Power Company, of Hackensack, N. J., with a capital stock of $100,000, has been organized by Cyrus O. Baker, Jr., of Newark; Wm. A. Linn, of Hackensack, and George H. Guy and Herbert B. Coho, of New York city.

The company has secured the Saddle River water power at Arcola, which it will utilize by excavating a lake, building a dam and putting in modern turbine wheels. By this means it expects to furnish electricity, which it will offer for lighting and power, to different parts of Bergen and Passaic counties, at a price much less than has ever been charged. It will also be prepared to sell electric power for trolley and mechanical purposes. The report of the surveyor shows that the company will have water-power varying from 75 horse-power, in a very dry season, to 300 or 400.

The location of the plant is in an admirable position to command patronage, and is in the center of a district where just now there is remarkable electrical activity.

Chicago Electrical Association.

Mr. Albert Scheible will read a paper, entitled "Electric Street Lighting of Yesterday and To-Day," before the Chicago Electrical Association at 8 P. M. on March 17. A discussion will follow the paper.

Vice-President Fuller has assumed the general management of the Chesapeake & Potomac Telephone Company, of Washington, D. C.

The Bates Electric Fans.

In the accompanying illustrations are shown several meritorious types of electric fans manufactured by the well known firm of D. L. Bates & Bro., of Dayton, Ohio. In Fig. 1 is shown the Bates four-blade, stationary, direct-current, electrolier fan. The motor is provided with but a single self-oiling bearing, extending the entire length of the motor, making it impossible to get out of line, and rendering it perfectly noiseless. The illustration shows the fan with a switch, which is protected by the housing at the fitted bottom of the ornamental casing. These fans are finished in nickel-plate, oxidized copper, or polished brass, and with or without lights and switch, if desired.

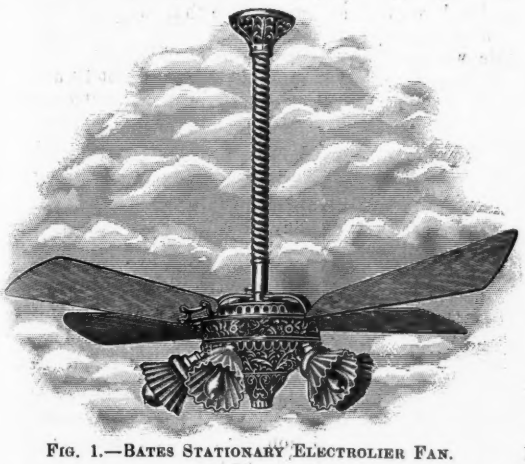


FIG. 1.—BATES STATIONARY ELECTROLIER FAN.

FIG. 2.—BATES 16-INCH DIRECT-CURRENT DESK FAN.

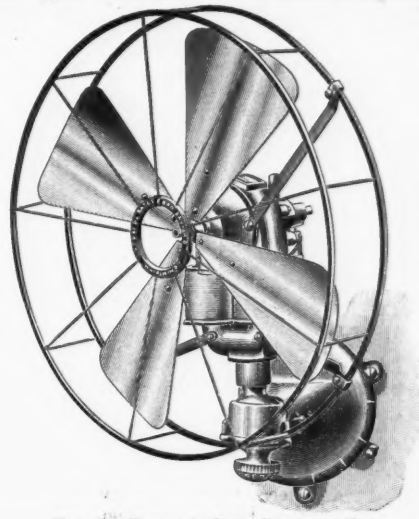


FIG. 3.—BATES 16-INCH BRACKET FAN.

A 16-inch direct-current desk fan is shown in Fig. 2. It has three speeds—800, 1,200 and 1,500 revolutions per minute. The motor fields are of drop-forged steel, and the fan is very economical in its consumption of current. It is finished in a combination of black enamel and polished brass, with an oxidized copper guard. Fig. 3 shows a 16-inch bracket fan constructed practically the same as the one shown in Fig. 2, excepting that it is provided with a bracket for attachment to a wall. The bracket is provided with a ball and socket joint, so that the fan may be set to throw a current of air in any direction.

FIG. 2.—OFFICES OF THE CENTRAL TELEPHONE AND ELECTRIC COMPANY, ST. LOUIS.

New York Electrical Society.

The 195th meeting of the society will be held in room 301, Engineering Building, Columbia University, on Thursday, March 9, at 8.15 P. M. Mr. W. S. Jenks will lecture on "Modern Research Into Lightning Phenomena and Building Protection."

Mr. Jenks's remarks will be followed by a paper by Mr. A. J. Wurts, on "Original Investigation Into the Protection of Electrical Circuits from Lightning," with some entirely new and important experimental demonstrations.

INSPECTION OF AND REPAIRS TO AUTOMATIC BLOCK SIGNALS.

READ BEFORE THE RAILWAY SIGNALING CLUB, OF PHILADELPHIA, FEBRUARY 21, 1899, BY W. A. D. SHORT.

The problem of maintaining automatic block signals is an important one. The use of such signals is becoming daily more common. The question of distribution of labor, so as to obtain the best results, is largely governed by local conditions, and is often hard to decide. Especially is this the case when there is a limited number of maintaining men to be drawn from. Is it best to give one man charge of, and hold him responsible for a large territory, furnishing him with inferior help to make the necessary battery renewals and do the rougher part of the work, or should we shorten the territory, bring up the standard of the men (consequently paying higher wages), and have one man do all necessary maintenance work, and thus hold him responsible for every detail? The second alternative would seem to be the one productive of the best results, as it should insure more constant and rigid inspection of all the working parts of the signals and the principal mechanisms. At the same time better service should be obtained not only from this inspection, but also because a signal out of order can be more promptly attended to.

On the Cincinnati Southern both methods are in vogue, but the first is used as a means to the end of obtaining the second, the inexperienced men being put with the experienced as batterymen and laborers until they have learned enough to be able to care for the signals. When this time arrives, the territory is re-divided, and each man has a smaller number of miles to the section. The average number of miles covered at present by an inspector, or maintaining man, is about 27, the longest section being 43 miles in length and the shortest 14. In this long section there is a space of 17 miles where there are no automatic block signals, so that the actual length of track protected is 26 miles; but valuable time is lost by the inspector in getting over the intervening space. In the final redistribution of the inspectors it is intended that the territory to be covered by one man should be about 14 miles, or some 10 miles less than the present average. The average number of signals maintained by one inspector will be 17.2.

In single track work the automatic block signal is an absolute signal. In other words, when the signal stands in the danger position, or remains at safety for an approaching train, and fails to change properly, the train must stop and flag through the block. This entails considerable loss of time, if the signal is not in working order; so that it is important that quick and efficient service be had. With this end in view every facility for prompt notification to maintaining men should be furnished. If a train is delayed by the improper working of a signal, the fact should be reported by telegraph to the superintendent from the first open telegraph station, and copies of this message should be sent to the maintaining man and to the office of the signal department. Maintaining men should be provided with railroad velocipedes to enable them to get over the road promptly, irrespective of trains. On the Cincinnati Southern every passenger train carries one of these velocipedes in the baggage car, for use by the head flagman when necessary to flag a block. These cars are fitted with appropriate brackets for holding a red flag during daylight and a red and white lantern at night, with accompanying torpedoes and fusees.

Inspectors or maintaining men should be required to go over their entire territory daily. All relays and working parts of signals should be inspected daily. The inspector should endeavor to go over his territory in one direction on a train, and in the opposing direction on a velocipede; by this method the signals are observed under two different conditions, and defects in their working can be readily ascertained and quickly remedied, as the inspectors should take their velocipedes with them while using trains. Inspectors should post, daily, in telegraph office of their headquarters, a notice stating at what point on the line they expect to be during the day and the quickest way in which they can be reached, if emergency arises.

If possible, men should be procured for maintaining who have had some experience in line work, or at least know how to climb poles. When this is done, the signal man can be required to look after the ordinary repairs of the telegraph lines, in addition to the signal line wires, in his territory. This can be done without appreciably interfering with the signal work, and it greatly helps the telegraph service.

Relays should be adjusted when they are first put in service, and inspectors should be taught not to touch the adjustment. In case of failure they should look for the cause of failure elsewhere, and not take up any of the ordinary leakage of circuits by readjusting the relay.

In the disk form of signal the counter-weight should be properly adjusted when signal is first put into service. It is not necessary to change this adjustment, and maintaining men should be so instructed. They should be taught that, if the signal hangs in the danger position without apparent cause, this defect should be overcome by the addition of more battery on the signal circuit rather than make a slightly different adjustment of counter-weight. Very little trouble is experienced from this form of signal standing at safety on account of improper adjustment of counter-weight, but if this trouble should arise the inspector should report the case to the signal office, and not endeavor to change the weight.

Switch boxes should be inspected frequently—not less than every fortnight—and exterior parts, such as switch point lugs and the bolts in them, should be inspected daily. In inspecting switch boxes care should be taken to ascertain that rollers are tight on the shaft and properly adjusted, so as to throw the signal to danger when the point is opened three-eighths of an inch. In adjusting switch boxes care should be used, particularly to make sure that the signals are held at danger during the full movement of the switch, including the full open position. There have been instances where switch boxes have been adjusted so that signals would go to danger properly when the point was opened three-eighths of an inch, but the current would be restored to its normal course and the signals go to clear when the switch was full open. The shunt method of connecting switch boxes seems to be preferable to the method of break and shunt, or simply break of current. There has been no difficulty from this method of throwing signals to danger when necessary, whereas in all forms of break connections signals are constantly going to danger on account of the opening of circuit in contact points, or springs, when it is not intended for it to do so.

The best method of maintaining lamps has not been definitely decided. Should the signalman himself take charge of the maintenance of the lamp, and be directly responsible for it? This method would seem, especially on long sections, impracticable, as it would constantly be calling maintaining men away from their signal work, or from important repairs, to attend to the lamps. Trackmen can take care of lamps; but they do not give good results, on account of lack of proper attention to all parts of the lamp. The best method would seem to be to allow trackmen to attend to cleansing, re-oiling and placing in position all the signal lights, and to hold signalmen responsible for these lamps getting proper attention. If this is done, a signalman will report improper attention quicker than would be done otherwise. If we can get a lamp that will burn a certain number of hours and then go out without attention, it will save half the labor necessary for the maintenance of the lamps, as only one trip a day would have to be made by the lamp tender.

ELECTRIC RAILWAY NOTES.

The contract has been let to Boston parties to build the Sanford & Cape Porpoise, Me., electric road, and bonds have been placed for $250,000, and the road is to be completed July 1.

General Manager Bancroft, of the Boston Elevated Railway Company, is reported as saying that elevated railway cars will be in operation in Boston a year from next Summer.

The Knickerbocker Trust Company, of New York, has filed suit in the United States District Court at Cincinnati, Ohio, against the Ironton Electric Light and Railway Company for the foreclosure of $300,000 of bonds, and also asks the appointment of a receiver to take charge of the company's affairs.

The Massachusetts Railroad Commissioners have approved the purchase of the Braintree Street Railway Company by the Quincy & Boston Street Railway Company. An exchange of shares is ordered made at the ratio of five Quincy & Boston Railway shares for six shares of Braintree Street Railway Company. The number of shares of Braintree Street Railway Company stock outstanding, 1,000.

A reorganization has been effected in the Lansing-Dexter & Ann Arbor, Mich., Railway Company, and the name changed to the Lansing, Dexter & Ann Arbor Electric Railroad Company. The new officers elected are: C. A. Mapes, president; R. J. Shank, vice-president; C. B. Black, secretary; Thomas Birkett, of Dexter, treasurer. The directors are C. P. Black, C. A. Mapes, R. J. Shank, R. A. Montgomery, Morris Topping, of Plainfield, and L. E. Chase, of Dansville.

Fort Wayne Electric Corporation's Receivers.

Pending the election of a trustee, Mr. Samuel L. Morris, an attorney, and Mr. C. H. Worden, representing the management, have been appointed, under the Federal Bankruptcy Act, receivers of the Fort Wayne Electric Corporation, of Fort Wayne, Ind. Mr. Morris is quoted in a Fort Wayne newspaper as saying:

"There has been no wholesale reduction of the force, save to comply with the order of the court, which requires that we shall only retain a force sufficient to keep the works in operation, and fill existing contracts. The moneys to be expended for supplies to finish the contracts is limited to $8,000, which is not very much. On Monday or Tuesday all of the wage-earners of the plant will be paid off in full, as the order of the court specifies that they are to be paid not to exceed $300 each, for three months prior to adjudication, and to none of the wage earners is the corporation indebted to any such amount."

ELECTRICAL INSTALLATIONS AT THE WASHINGTON, D. C., NAVY YARD.

THE NEW MODEL TESTING BASIN.

The installation and completion of a new electric lighting plant at the Washington Navy Yard, Department of Ordnance, is rapidly going forward.

During the late war with Spain the necessity for the hurried completion of large guns and repairs to guns, gun carriages, etc., compelled this, one of the most complete ordnance departments of the government, to work a night force. For probably the first time in its history the inadequacy of light for night work became evident. The electrical engineer of the yard being without an appropriation, labored to his utmost with what he had at hand to supply this demand for light, and the consequence was a hurried and temporary construction of lines was made; homemade wooden switchboards used and second-hand machines installed at any available spot. This kind of work, before the critical eyes of naval officers, brought to their attention very forcibly the urgent need of a large and complete electric plant capable of not only lighting the great machine shops, barracks, officers quarters and operating the enormous cranes used in lifting heavy guns, large castings, etc., but also to supply current for light to those boats coming to the navy yard and remaining there any length of time—and, incidently, the two captured Spanish gunboats now stationed at this yard.

For this purpose one of the smaller two-story buildings, formerly used as a storeroom, has been remodeled and enlarged, and it is now to be exclusively used as an electrical building. The lower floor is occupied by the plant and electrical storeroom, and the upper floor as an office, and an experimental electrical laboratory.

The equipment consists of two sets of Ball & Wood cross-compound 150-horse-power engines, each direct connected to two 200-kilowatt 112-volt direct-current General Electric generators. One Ball & Wood tandem 80-horse-power engine, direct-connected to two 50-kilowatt, 112 volt, direct-current General Electric generators, and two Thomson-Houston series 50-light arc machines belted to an Armington & Sims 60-horse-power engine. These arc machines formed a part of the old plant and will probably be continued in use. Steam is supplied at a pressure of 120 pounds to the engines from the general boiler and steam plant of the yard. Two large pumps are installed for pumping water from the river, several hundred feet away, and these pumps are each operated by a 10-horse-power direct-current motor. Water is also furnished from the city main, thus insuring safety in case of accident to the pumping system.

The switchboard was manufactured and installed by the General Electric Company, and consists of 15 panels of black marbelized slate, about 72 inches high by 15 feet wide. It occupies a position in the center of the building, about four feet from the north wall, and is mounted on a cement foundation.

The six panels on the right of the board are used as feeder panels, and on each of four of these is mounted a round pattern voltmeter, with scale 0–150, one 800 ampere switch, and one General Electric circuit-breaker, with a rating of 0–500 amperes, and a rheostat. The other two feeder panels are exactly as above, with the exception that 500-ampere switches are used instead of 800-ampere switches. The large center of regulating panel has mounted upon it an illuminated dial ground-detector reading 150–0–150, a ground-detector switch, and four six-point voltmeter switches. The two lighting panels control six circuits, and upon each of these panels is mounted two 200-ampere and one 300-ampere three-pole switches, a Western Electric ammeter reading to 1,000 amperes, and a voltmeter switch. On each of the six power panels, occupying the entire left-hand end of the board, are mounted a round pattern ammeter reading to 500 amperes, and two two-pole 500-ampere switches and a General Electric circuit-breaker, with a rating of 0–500 amperes. Mounted in pairs on hinged arms at either end of the board are four illuminated-dial station voltmeters, one pair controlling the lighting system and the other the power system.

The three-wire system is used throughout, 110 volts on a side for lighting and small power purposes, and 220 volts for the power system.

The crude construction of the old plant—namely, a wooden switchboard, second-hand dynamos and engines, wooden poles, dangling wires—is all being replaced by an entirely new and modern outfit. Iron poles are substituted for the old wooden style, and the lines are now run on a complete system, and nearly every one of the many large machine shops—the largest of their kind in this country, in one of which is used the second largest lathe in the world, it being capable of handling a 16-inch gun with an ease equal to that of a jeweler's lathe handling a delicate piece of gold—has now its quota of the "juice," as well as the many other buildings of this great ordnance department. Each building has a complete system of iron-armored conduit in connection with the Bossert steel-clad junction and outlet boxes, which makes an ideal fireproof installation. Each workman's bench now has its electric light, and the general space is illuminated by Adams–Bagnall arc lamps. Lines are run to the river front, and naval vessels when there for any length of time are supplied with current.

The above described equipment is for the yard proper, but in this navy yard, and now in course of construction, is to be one of the most intricate electrical installations ever attempted in this and probably any other country.

In the lower southeastern part of the navy yard, just at the water front, is a large, low building, about 600 feet long by 80 feet wide, and over the entrance is marked "Experimental Model Basin." From within the limits of this building the naval world is expecting to hear of some very wonderful developments.

The entire floor space of this building, excepting a footpath on either side and a steel track for the electrical towing carriage, which is operated somewhat like a large crane, is occupied by a basin of water five feet or more in depth, 550 feet in length and about 70 feet in breadth. This large basin of water is intended for the purpose of testing the speed, water resistance, draught, displacement, etc., of our modern naval vessels. Everything connected with this experimental station is to be operated electrically, and while the details of its construction and operation are kept secret, the writer was enabled to go through the station, and he gives this brief recital of what he saw to the readers of the ELECTRICAL REVIEW.

A model of wood is made of one of our large battle-ships (a model of the "Indiana" is nearly completed and will be the first experimented with). The model is floated in the basin and its length, breadth, displacement, etc., is supposed to be exactly in proportional ratio to the battle-ship after which it is modeled. The model is then tightly clasped by the electrical towing carriage and the same is started and can be run, when required, at the rate of 30 miles an hour and goes a distance between 400 and 500 feet, when it is stopped. At this great speed the carriage can be brought to a standstill within 20 feet. The instruments used is the test record the displacement, water resistance, speed, and in fact every detail is noted, and finally the model is altered here, changed there, cut at one point, enlarged at another, deepened or shallowed until science, not in theory only, but from actual test, gives to our naval constructors a model of a ship holding out the best points obtainable for great speed with the least horse-power, the proper shape with the least water resistance, and the greatest capacity with the minimum of displacement.

This experiment with models has but once before been attempted, and it was on a much smaller scale and with none of the improvements incorporated in this one, which improvements are due mostly to the wonderful progress and development in electrical application.

This entire equipment in every minute particular, including the designing of special electrically operated model making machines, is the work of one young man, whose name is withheld by request.

Across the way from the model basin is a small electric plant which is to do this work. It consists in duplicate of one 150 horse-power McIntosh & Seymour simple engine direct-connected to a 200-kilowatt General Electric multipolar generator, and can be used in series or in multiple for 250 or 500 volts, as desired. The switchboard, comprising but six small panels, is intricately arranged, and by its back connections and double-throw switches current can be had to operate either one of the two different systems of electrical application.

All of the larger tools in the model-making room of this experimental plant are operated electrically, and it is the intention that every portion of a ship's model will be made and put together in this one shop, ready for test.

The model of the "Indiana," spoken of above, was selected as a unit to work from, as its speed, displacement, etc., are known, and this will form the basis of an experiment from which great results are expected and for which Congress has already appropriated $250,000. G. H. D.

An Excellent Correspondence School.

All students of the Electrical Engineer Institute of Correspondence Instruction, as well as others connected with the electrical profession, will be interested to learn that this enterprising institution has secured the services of Mr. Alfred E. Wiener, the well known author and electrical engineer, who assumes charge of the instruction department as chief instructor of the institute. Mr. Wiener is not alone an exceptionally well informed engineer, but possesses, as well, the rare gift of imparting knowledge to others. The students of the institute will be greatly benefited by this arrangement.

Among the corps of authors and instructors which the institute has gathered around it, are now numbered many of the most prominent electrical engineers of the country, so that the student enters upon his studies with the satisfying conviction of having intrusted his electrical education to an institution the good faith, trustworthiness and technical reliability of which stand unquestioned. Students and those who are desirous of becoming such are cordially invited to call at or write to the home offices of the institute, 120 Liberty street, New York city, where Mr. Herman A. Strauss, the general manager, will be at all times pleased to discuss or correspond in detail with them as to their individual needs and assist them in selecting the most suitable course.

ADVANCE INFORMATION

New Incorporations.

CAZENOVIA, IOWA — The Union Electric Company has been incorporated; authorized capital, $25,000; incorporators, David O'Connell, Marathon; Thomas O'Connell, N. S. Miller, J. Dougherty, Cortland; J. O'Connell.

ELIZABETH, N. J. — The Chase Electric Construction Company has been incorporated. Its objects are to manufacture, purchase, operate and maintain various electrical apparatus and deal in all things incidental to the carrying on of such business. Its principal office will be located in Plainfield, and the authorized capital stock is $500,000. The incorporators are Albert Chase, Louis Chase, Amelia T. B. Chase, Juliette Chase and ex-Sheriff George Kyte.

PITTSBURGH, PA. — The Church Manufacturing Company has been organized, with a capital of $100,000. The company will manufacture the mechanical and electrical inventions of Walter A. Church. A plant is to be erected at a cost of about $40,000, and work will be commenced as soon as a site is secured. Oliver H. Ormsby is the promoter of the enterprise.

CAMDEN, N. J.—The Miller Electrical Maintenance Company has been incorporated to carry on a general electrical business; capital, $100,000; incorporators, J. J. Miller, Charles E. Schmunk, Pittsburgh, Pa.; James R. Baird, Allegheny, Pa.; W. C. Thomas, Pittsburgh, Pa.; Wm. Bader, Allegheny, Pa.

CHICAGO, ILL.—The Cellular Insulator Company has been incorporated; capital stock, $2,500; incorporators, Alfred W. Irwin, Max Jenney and George B. Havercamp.

SAN FRANCISCO, CAL.—The Winfield Resetting Circuit-Breaker Company has been incorporated to carry on an electrical and mechanical apparatus manufacturing business; authorized capital, $10,000; capital subscribed, $50; incorporators, E. F. Winfield, A. A. Anderson, C. L. Ackerman, A. E. Brooke-Redley, S. L. Naphtaly.

New Telephone and Telegraph Companies.

SURRY, VA.—There is a project on foot to connect this place by telephone with Smithfield, and thence over the line there with Norfolk. Nearly enough money has been subscribed to build the line, and work will begin soon.

MILFORD, N. Y. — The Milford Telephone Company has been incorporated to operate a system of telephone communication from Oneonta to Richfield Springs, Otsego County; capital, $1,000; directors, George Whitney, C. B. Kniskern and C. E. Carr, of Milford; H. E. Kinney, Lee Kinney and George Swartout, of Hartwick Seminary, and A. H. Clark, of Fly Creek.

CORINNA, ME.—The Corinna Telephone and Telegraph Company has been incorporated. The officers are: President, T. F. Burrill; clerk and treasurer, E. McFarland; directors, the officers and A. McFarland. It proposes to operate a telegraph and telephone line between Corinna, Newport, Stetson, Exeter, St. Albans, Hartland, Ripley, Cambridge, etc. The capital stock is $10,000.

DOVER, ILL.—The Dover Telephone Company has been incorporated; capital stock, $2,000; incorporators, Charles O. White, M. H. Blackburn and James W. Sabin.

HOPEWELL, N. J.—The Hopewell Telephone and Construction Company has been incorporated to carry on a telephone business; capital, $3,000; incorporators, John N. Race, Theo. A. Pierson, David L. Blackwell.

VINTON, IOWA—The Vinton Telephone Company has been incorporated to operate a telephone line in Iowa; incorporators, F. G. Ray, S. S. Lichty, A. S. Chadbourne, W. P. Whipple, W. S. Goodhue.

Electric Light and Power.

JERSEY CITY, N. J.—A project is on foot to organize a new electric light company in North Hudson. Robert Scheffbauer, of this city, is one of the promoters. It is to be known as the Consumers' Electric Light Company, and will be conducted on a co-operative basis, consumers being the stockholders. The capital stock will be $100,000, divided into 1,000 shares of $100 each.

INDIANAPOLIS, IND.—The Chenoweth Light and Power Company has been incorporated; capital stock, $40,000; directors, D. A. Chenoweth, D. D. Smith, A. H. Harmon.

NEWARK, N. Y.—The New Light, Heat and Power Company has been incorporated; capital, $25,000.

WINDBER, PA. — The Windber Electric Company has been incorporated to supply light, heat and power; authorized capital, $10,000; incorporators, H. A. Berwind, E. L. Myers, Thos. Fisher, Philadelphia; W. A. Crist, Osceola Mills; J. S. Cunningham.

CHICAGO, ILL.—The Kenilworth Light and Fuel Company has been incorporated to furnish light, heat, etc.; authorized capital, $50,000; incorporators, Joseph Sears, Horace Kent Tenney, M. Lester Coffeen.

NEW YORK, N. Y. — The City Lighting Company has been incorporated to furnish lights; authorized capital, $1,000,000; directors, John M. Ryan, Frank T. Hearns, John S. Griggs, Jr.

EAST RUTHERFORD, N. J.—The Rutherford and Suburban Electric Light and Gas Company has been incorporated to supply electricity for light, heat and power; capital, $200,000; incorporators, Cornelius Fitzgerald, Rutherford; Andrew L. Fennessy, New York; Wm. E. R. Smith, East Orange.

New Electric Railways.

FREEPORT, N. Y. — The Mineola, Hempstead & Freeport Traction Company has been incorporated; authorized capital, $125,000; incorporators, James A. Stiles, Hempstead, L. I.; Charles Hills, J. A. McElhinny, Peter C. Ackerman, New York; James L. Jensen, Brooklyn; Louis Heck, Newark, N. J.

TRENTON, N. J. — The Trenton, Lawrenceville & Princeton Railroad Company has been incorporated, with a capital stock of $200,000, to operate a railroad in Mercer County, nine and one-half miles in length, between Trenton and Princeton.

READING, PA.—A movement has been instituted for the construction of an electric railroad from this city to Hamburg, Berks County, 18 miles north of Reading.

CHAGRIN FALLS, OHIO — The Cleveland & Chagrin Falls Electric Railroad Company will extend its line from this place to Warren, and the line will be known as the Chagrin Falls & Eastern.

GRAND HAVEN, MICH.—The Grand Haven Common Council recently granted a franchise to Grand Rapids capitalists for an electric railroad from here to Grand Rapids. The road will be running by July. The power-house will be located at Coopersville.

HIGHLAND, ILL.—The Highland Electric Company has been incorporated; capital, $15,000. The incorporators are Will M. and Norman P. Rickett, of Peoria, and G. H. Atkins, of Chicago.

PHILADELPHIA, PA.—There is talk now of extending the Bridgeton trolley to Mullica Hill, thence to Mantua, to connect with the Camden, Gloucester & Woodbury Railway.

PRIZES WERE AWARDED FOR INVENTED WORD for a liquid beef tea in the competition advertised in this paper in Nov. or Dec., 1898 (B. T., P. O. Box 2718, N. Y. City), as follows: 1st ($25.00), to Emily Wing, Los Angeles, Cal. 2d ($10.00), to W. M. Ostrander, Philadelphia, Pa.

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[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED FEBRUARY 28, 1899.

620,111 Cutout; Edward Ellicott, Chicago, Ill.—An electric line terminal consisting of a rounded lug adapted to be secured to an insulating base-plate, a terminal portion provided with a receptacle for the connected conductor, and a sleeve rotatably fitting upon said lug and adapted to be secured in position thereon.

620,117 Arc lamp for electric lighting; David Gertin, Corning, N. Y.—A globe or envelope for the arc, closed at the bottom and having a restricted orifice in its peripheral walls for the admission of air below the arc and a passage above the arc for the escape of the gaseous products of the arc.

620,144 Multiphase current transformer; E. L. K. Kahlenberg, Berlin, Germany—A source of multiphase current of a transformer for supplying secondary circuits and having multiphase windings and switching apparatus for connecting windings of the transformer either in star or triangle fashion.

620,172 Secondary battery; G. Philippart, Paris, France.—An electrode comprising a conductor, active material and surrounding sleeve composed of superposed washers of ribbed or corrugated material.

620,196 Electric switch; H. O. Swoboda, New York, N. Y.

620,197 Coin-controlled electrical apparatus; R. W. Taylor, Chicago, Ill.

620,214 Carbon-holder for electric arc lamps; S. Bergmann, New York, N. Y.

620,239 Electric motor suspension; Geo. Gibbs, Philadelphia, Pa.—A supporting frame for an electric motor of an electric vehicle consisting of a frame, spring supported at one end from the axle and spring supported at the other end upon the opposite side of the axle upon the equalizing bars of the truck.

620,254 Four-tub electric bath; C. E. Schnee, Carlsbad, Austria-Hungary.

620,256 Means for suspending electric motors; S. H. Short, Cleveland, Ohio.

620,283 Regulating transformer; E. W. Cowan, Bowdon, Eng.

620,302 Automatic cutout for electrical transformers; W. J. Greene, Cedar Rapids, Mich.

620,306 Electrically heated tool; W. S. Hadaway, Jr., New York city—Consists of a heating body and an electrode adjustable to and from the same to form an arc, a sleeve of refractory insulating material surrounding the electrode adjacent to the arc, such sleeve serving to insulate the electrode and support it movably adjacent to the body.

620,307 Process of forming magnesia insulation upon conductors; W. S. Hadaway, Jr., New York city.

620,308 Incandescent arc light; W. S. Hadaway, Jr., New York city—Consists of electrodes of uniform cross-section, a refractory sleeve fitted close to the same about the arc, and adapted when the light is in operation to be heated to incandescence in proximity to the arc.

620,309 Electric fuse; W. S. Hadaway, Jr., New York city—A magnesium wire or strip employed to conduct and to break the current, and adapted to oxidize below the point of fusion and thus forming an infusible conductor under such conditions.

620,319 Automatic indicating drop for annunciators; J. Hewitt, Pittsburgh, Pa.

620,326 Electric recording apparatus; C. L. Jaeger, New York, N. Y.

620,327 Electric recording system; C. L. Jaeger, Maywood, N. J.—A movable body made of non-conducting material and provided with an opening or slot permitting the passage of sparks, means for moving a strip or chart, means for producing sparks and electrical connections.

620,333 Direct-current motor and method of operating same; B. G. Lamme, Pittsburgh, Pa.

620,334 Direct-current system of electrical distribution; B. G. Lamme, Pittsburgh, Pa.

620,335 Method of and means for varying speed of direct-current motor; B. G. Lamme, Pittsburgh, Pa.—The method of operating direct-current electric motors at different rates of speed which consists in varying the phase relation between current and electro-motive force in the armature circuit, whereby the armature reaction is varied.

620,336 System of electrical distribution and regulation; B. G. Lamme, Pittsburgh, Pa.

620,343 Rotary transformer regulation; R. D. Mershon, New York, N. Y.

620,365 Means for, and method of, electro-motive force regulation; N. N. Rowe, Wilkinsburg, Pa.

620,404 Electric railway; L. M. Aspinwall, Pittsburgh, Pa.

620,440 Telephone switch; W. D. Gharky, Philadelphia, Pa.

620,473 Electrical machine; G. F. Martin, Corydon, Ind.—A stationary armature plate and a movable motor plate, and means for adjusting the armature plate.

620,491 Telephone switchboard; J. M. Ovensginer, Elwood, Ind.

620,514 Potential regulator for dynamos; A. A. Tirrill, Whitefield, N. H.

620,537 Coin-controlled mechanism for electric meters; W. F. Browne, New York city.

620,547 Signal system; E. L. Hail, Providence, R. I.

620,549 Electric railway; J. F. Munsie, New York, N. Y.

BUSINESS NOTES.

The Bullock Electric Manufacturing Company, Cincinnati, Ohio, has issued a card calendar for March. It is the handsomest specimen of color printing ever received by the ELECTRICAL REVIEW.

Eugene Munsell & Company, of New York and Chicago, are prepared to separate street railways and electrical manufacturers from their money by giving them in return good India and amber "Mica" for electrical insulation.

During the Winter months Garton-Daniels Electric Company, of Keokuk, Iowa, have, at times, found business somewhat dull in the lightning arrester line. The past few months, however, have differed from the same months of previous years owing to the receipt of several large orders for export. In January nearly 80 per cent of their shipments went abroad. This is highly gratifying. They have just issued a new descriptive and complete catalogue which is mailed without charge upon application. Their new net price-list makes some attractive prices, and should be in the hands of every possible buyer of lightning arresters.

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"Insulation" elsewhere announces a sale of interest to street railway supply houses. The article is one of the standard insulations, and the plant to produce it will be sold cheap.

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The Chicago Telephone Company have explained their reasons for asking for an extension of 20 years for the present ordinance, which has yet 10 years to run. This they are doing through an interesting article signed by President Clark and the directors. It would seem that this is a commendable way of laying the matter before the public, and what they state seems to be fair to all subscribers For instance, it is proposed, on condition the council will approve and pass their application, to greatly reduce rates. The company give three reasons for asking the extension of their ordinance; namely, that they may be enabled to equalize and reduce rates to their present subscribers; that by reason of these reduced rates telephone facilities may be placed at the disposal of many who do not now have them; that they may be warranted in making the large investment necessary to provide these facilities. A forty-dollar per annum rate is offered for a four-party line telephone for residences, calls not to exceed 400 per year, and an additional charge of eight cents for each additional call. A sixty-dollar rate is offered for business or private 'phone two-party line, not exceeding 600 calls; additional calls at the rate of six, five, four and three cents, according to the number of calls sent. For a ninety-dollar rate a metallic circuit long-distance 'phone is offered, this not to exceed 900 calls, and additional calls being charged same as above: six, five, four and three cents, according to the number of calls needed. Whether the council approve the application or not, it is the intention of the Chicago Telephone Company to give their patrons the very best service, and no reasonable expense will be spared to do so.

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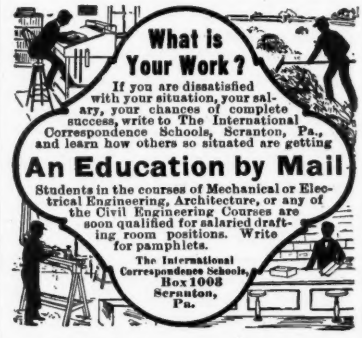
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